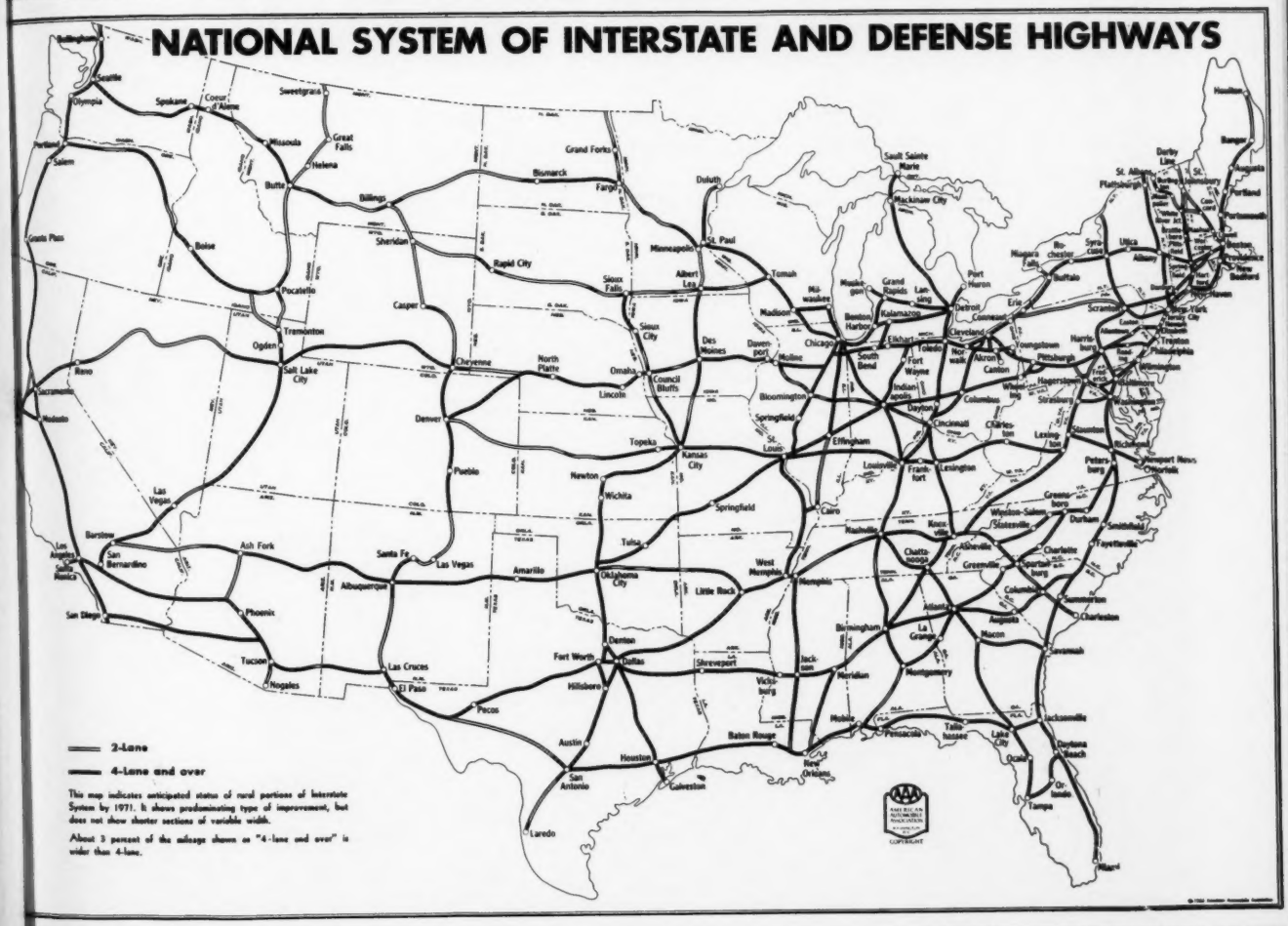
DECEMBER, 1956

TRAFFIC ENGINEERING


NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS
2-Lane
4-Lane and over
This map indicates anticipated status of rural portions of Interstate System by 1971. It shows predominating type of improvement, but does not show shorter sections of variable width.
About 3 percent of the mileage shown as "4-lane and over" is wider than 4-lane.
COPYRIGHT

- **The Effect of Letter Width and Spacing on Night Legibility of Highway Signs**
- **Recognizing and Realistically Planning for Large City Transportation Growth**
- **Moving Vehicle Method of Estimating Traffic Volumes**
- **Roadside Interviewing on Lake Shore Drive**

INSTITUTE OF TRAFFIC ENGINEERS
ITE
FOUNDED 1930

Certificate of Satisfaction

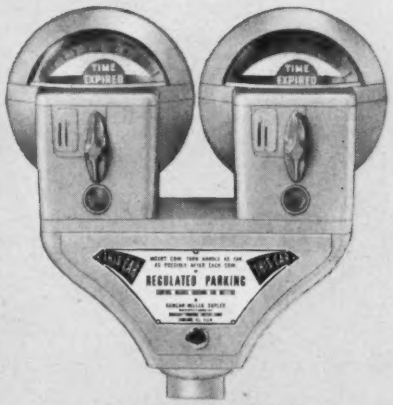
Whereas over 1,800 municipalities enjoy complete satisfaction with "heavy duty" DUNCAN-BUILT products, and

Whereas more new cities daily discover the genuine economy of DUNCAN's "NO WIND" feature, and

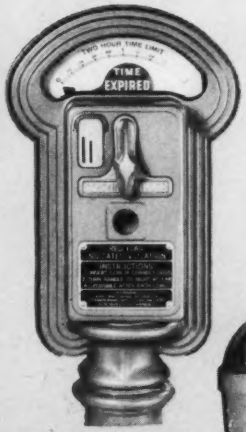
Whereas each DUNCAN product represents the finest in engineering, resulting from over 20 years of parking meter experience.

Now therefore, we certify that DUNCAN's dependable all-weather operation will earn your unqualified endorsement of this certificate.

Duncan-Miller Model "60"



Duncan-Miller Duplex



Duncan-Miller Model "50"

Duncan Fine-O-Meter

Duncan-Automaton

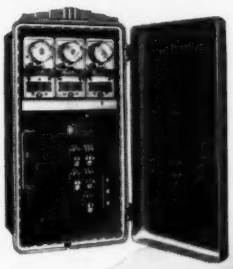
DUNCAN PARKING METER CORP.

835 NORTH WOOD STREET, CHICAGO 22, ILLINOIS

FACTORIES: HARRISON, ARKANSAS AND MONTREAL, P.Q., CANADA

Manufacturers of fully automatic and manual parking meters.

GROWS AS YOUR TRAFFIC GROWS!



The most flexible – and economical – solution to future changes in traffic flow is the Crouse-Hinds Type LF Expansible Controller: A full flexible-progressive, variable time cycle traffic signal control that may be used with *any* existing *Trafflex* system.

The Type LF is supplied with 1, 2, or 3 jack-mounted dial-units. The *single timing motor* is attached to dial #1, and activates the other dial or dials through a simple, reliable system of gears. Any time cycle ranging from 40 to 120 seconds can be set manually or programmed automatically at the master controller. It instantly affects the dial-unit that is in use at the moment. Each dial-unit can be set for a different timing-split and a different offset.

All Type LF Controllers have provision for three dial-units regardless of the number of units originally purchased. They are available with 1, 2, or 3 resets on each dial-unit. When shipped from the factory, all controllers are wired for 3 resets. Resets 2 and 3 may be purchased originally or added at any time simply by installing dial contacts and switch arms.

Write today for full information on the Type LF Expansible Trafflex Controller . . . the Controller that "grows" with your Traffic control needs!

CROUSE-HINDS TYPE LF TRAFFLEX® EXPANSIBLE CONTROLLER

A NATIONWIDE DISTRIBUTION exclusively through ELECTRICAL DISTRIBUTORS

CROUSE-HINDS COMPANY

Main Office and Factory: Syracuse, N. Y.
Crouse-Hinds Company of Canada, Ltd.: Toronto, Ont.

OFFICES: Birmingham Boston Buffalo Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul San Francisco Seattle Tulsa Washington RESIDENT REPRESENTATIVES: Albany Atlanta Baltimore Baton Rouge Charlotte Chattanooga Jacksonville Reading, Pa. Richmond, Va. Shreveport

The Accident that *DIDN'T* Happen!

A dark, rain-swept night . . . a sharp curve —a side-swiped warning sign twisted dangerously away from oncoming traffic. Add a fast-moving car to this combination, and you have everything needed for a tragic accident. But this accident *didn't* happen!

Why? Because in this case, the vital warning sign was faced with Wide-Angle Flat-Top "Scotchlite" Reflective Sheeting—the only sign material that shows *true color*, *true shape*, and *true legend* with the same accuracy at night as it does by day . . . in foul weather as well as fair . . . *even when accidental damage or vandalism changes the angle of the face to the roadway.*

Wide-Angle Flat-Top "Scotchlite" Reflective Sheeting shows no significant loss of brightness even under heavy rain conditions; will continue to reflect efficiently even when turned or bent to extreme angles.

Add to these reasons the fact that it is the easiest of all sign materials to maintain. You'll quickly see why so many traffic and maintenance engineers standardize on Wide-Angle Flat-Top "Scotchlite" Reflective Sheeting for their road systems.

We'll be glad to send complete information without cost or obligation. Just write to Dept. GS-126, Minnesota Mining and Mfg. Co., St. Paul 6, Minn.

FOR SHAPE... COLOR... LEGIBILITY

REG. U. S. PAT. OFF.

SCOTCHLITE

BRAND

REFLECTIVE SHEETING

The term "Scotchlite" is a registered trademark of Minnesota Mining and Mfg. Co., St. Paul 6, Minn. General Export: 99 Park Avenue, New York 16, N. Y. In Canada: P. O. Box 757, London, Ont.

TRAFFIC ENGINEERING

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

Vol. 27 DECEMBER, 1956 Number 3

INSTITUTE OFFICERS

J. CARL McMONAGLE
President

JOSEPH E. HAVENNER
Vice-President

MATTHEW C. SIELSKI
Vice-President

EDWARD G. WETZEL
Secretary-Treasurer

DIRECTORS

ROBERT A. BURCH
District Number 5

GEORGE J. FISHER
District Number 4

GORDON K. GRAVELLE
District Number 2

HERBERT C. HIGGINS
District Number 6

GEORGE W. HOWIE
District Number 3

FRED W. HURD
District Number 1

CHARLES W. PRISK
Immediate Past President

PUBLICATION STAFF

DAVID M. BALDWIN
Editor

G. A. BACCHUS
J. W. CHAMBLISS
C. C. CLARK
L. W. CORDER
WM. E. CORGILL
R. E. DUNN
M. J. HUBER
WM. L. MARVIN
E. A. MUELLER
C. C. ROBINSON
S. T. SIEGEL
Associate Editors

CONTENTS

FEATURES

The Effect of Letter Width and Spacing on Night Legibility of Highway Signs 113
David Solomon

Recognizing and Realistically Planning for Large City Transportation Growth 122
E. E. Kearns

Moving Vehicle Method of Estimating Traffic Volumes 127
R. C. Blensly

Roadside Interviewing on Lake Shore Drive 132
Louis E. Keefer

INSTITUTE AFFAIRS

Secretary's Column 135
Coming Events 138
Yearbook Changes 140
Membership Applications 140
Section News 141

TRAFFIC NEWS

New Appointments 144
Strictly Business 145
New Publications 146

MISCELLANEOUS

Reference Notes 152
Positions Available 154
Professional Service Directory 154
and Inside Back Cover
Index to Advertisers 154

Cover picture used with permission of the American Automobile Association.

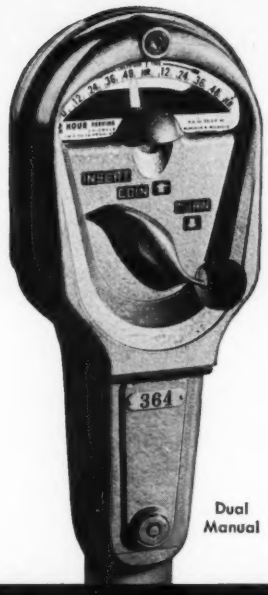
TRAFFIC ENGINEERING is published monthly by the Institute of Traffic Engineers. Editorial offices are at 2029 K Street NW, Washington 6, D.C. Advertising plates should be sent to Interstate Printing Corp., 400 Watchung Avenue, Plainfield, N. J. West Coast advertising representative is Jess M. Laughlin Co., 3757 Wilshire Blvd., Los Angeles 5, Calif.

Entered as second-class matter November 7, 1941, at the Post Office at Plainfield, New Jersey, under Act of March 3, 1879. ¶Single copies 40 cents, subscription price $3.50 per year in the United States; $4.75 per year to foreign countries.

The Institute is not responsible for any statements made or opinions expressed in its publications. Publication of advertising does not constitute Institute approval or endorsement of the products or services advertised. Permission to reprint contents with customary credit line is given unless otherwise stated.

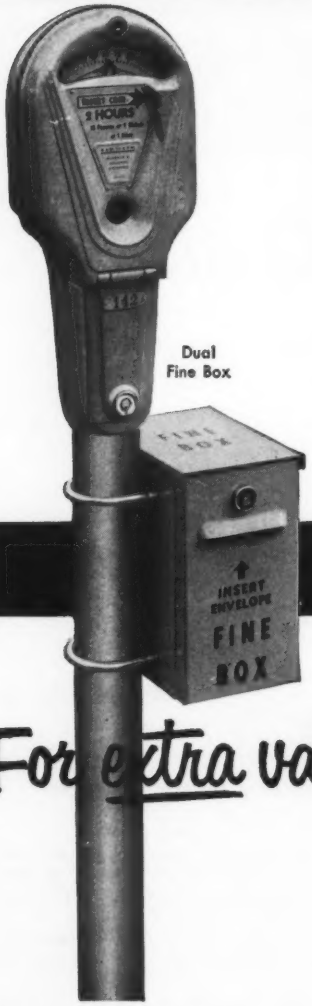
Dual
Automatic

Dubl-Dual
Automatic



Dual
Manual

For every parking control need there's a DUAL...



Dual
Fine Box

Dual
Park-Ateria

that's just right

• Yes, shown here are the basic Dual units ideal for *any* on-street or off-street need . . . Single and Dubl-Duals . . . automatic and manually operated Duals . . . the Dual Park-Ateria . . . and Dual fine boxes . . . all convert parking overhead into profits.

All have one thing in common—mighty important to you—the quality and leadership engineering that always pays off in *efficient* control, long life, minimum maintenance and *highest* net return on investment. Be sure to get *all* the facts. Write *The Dual Parking Meter Company* (Subsidiary of Rockwell Manufacturing Company), *Canton 2, Ohio.*

For extra value get **DUAL**
PARKING METERS

Frankly Speaking . . .

What Is A Traffic Engineer?

WHY, HE IS A TECHNICAL MAN, OF COURSE. The readers of TRAFFIC ENGINEERING know what he does much better than I do, but the general public too often regards him as just another public employee on the tax payrolls. That impression should be corrected.

The most effective person to inform the people is the traffic engineer himself. He can stimulate more editorials and news stories in the local newspapers. He can obtain spots on radio and television shows. Best of all he can find opportunities to describe his services to the people by personal appearances before school groups, women's groups, service clubs, fraternal organizations, church gatherings and other civic organizations. He can, in effect, improve his own public relations.

Transportation is the life blood of the nation. The movement of people and goods is essential to our social and economic existence. Motor transportation in our time has grown to maturity and presents problems as well as great benefits. So the traffic engineer plans adequate streets and highways, supervises their construction, determines the flow and desirable speed of traffic and thus facilitates transportation. His contribution needs to be better known.

Then too, the traffic engineer, in planning for adequate streets and highways, incorporates safety factors. He knows, for example, at which intersections signal lights should be placed. He plans for grade separations and control of access. Entrances and exits on conventional roads get his professional attention. Character of road surfaces is related to safety. Curves, grades, and sight distances are some more of the factors to be considered. This is all done for the people—their comfort, convenience, and safety.

Each traffic engineer owes it to himself and to his profession, now well established, to make his responsibilities and duties well known and thus well respected and well supported. No false modesty should interfere with this worthy purpose.

NED H. DEARBORN
President
National Safety Council

CHICAGO makes sure of longer message life with

6,000 signs of Alcoa Aluminum

Chicago looked at the record. It shows that in scores of cities, message life is doubled and often tripled when street and traffic signs are made of Alcoa® Aluminum.

So when the city's Park District planned the installation of 6,000 new street signs, Alcoa Aluminum was first choice. Both blades and brackets are Alcoa extruded shapes. Their resistance to corrosion ends rust damage. Their high strength minimizes loss by vandalism or collision. Their light weight makes erection faster, easier, cheaper.

Chicago chose to use reflective sheeting for peak visibility both night and day. But Alcoa Aluminum lends itself equally well to message films of paint or porcelain enamel, or to reflective buttons. Thirteen leading manufacturers are ready to help you cut costs with finished signs of Alcoa Aluminum—all ready to erect. Call the one nearest you, or write: Aluminum Company of America, 1682-M Alcoa Building, Pittsburgh 19, Pennsylvania.

Fasten Aluminum With Alcoa Aluminum Fasteners

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

WE CHOSE ALCOA ALUMINUM MILL PRODUCTS
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

These manufacturers sell finished signs of Alcoa Aluminum

AGA Division
Elastic Stop Nut Corporation of America
1030 Newark Avenue
Elizabeth, New Jersey

California Metal Enameling Co.
6904 East Slauson Avenue
Los Angeles 22, California

Cataphote Corporation
2505 Albion Street
Toledo 10, Ohio

Gopher Stamp & Die Co.
78 Chicago Avenue, E.
St. Paul, Minnesota

The Grote Manufacturing Co., Inc.
500 Lafayette Avenue
Bellevue, Kentucky

The Hunt Company
18308 James Couzens Hwy.
Detroit 35, Michigan

Lyle Signs, Inc.
2720 University Ave., S. E.
Minneapolis 14, Minnesota

Minnesota Mining & Manufacturing Co.
900 Fauquier Avenue
St. Paul, Minnesota

Mulholland-Harper Co.
5820 Tacony St.
Philadelphia, Pa.

National Safety Engineers, Inc.
3910 First Ave., South
Birmingham, Alabama

Standard Sign & Signal Co.
470 Main Street
Clinton, Massachusetts

Traffic & Street Sign Company
80 Foundry Street
Newark, New Jersey

Zumar Industries
1608 Essex Street
Los Angeles 28, California

Past President's Award Paper

The Effect of Letter Width and Spacing on Night Legibilty of Highway Signs

By David Solomon
(Jun. Mem., ITE)

Highway Transport Research Engineer
U. S. Bureau of Public Roads

This paper was the winner of the 1956 Past President's Award of the Institute of Traffic Engineers.

The paper was first presented at the 35th Annual Meeting of the Highway Research Board, Washington, D. C., January, 1956. It was subsequently printed in the April, 1956, issue of Public Roads.

IN RECENT YEARS, increasing use has been made of white reflectorized letters on a dark background for large highway destination signs. Although there are some conflicting reports, the weight of the evidence indicates that, for night legibility of large letters, this combination is superior to dark letters on a white reflectorized background. Consequently, a design using white reflectorized letters on a dark background was selected for signs recently installed on the Pentagon road network just outside of Washington, D. C. Standard alphabet designs for highway signs developed by the Bureau of Public Roads were employed.

The letter spacings used for the design of the Pentagon network signs were originally devised from limited tests and previous researches dealing with letter spacing and legibility, all with black letters on a white background. The spacing values were selected so that the white areas between would appear equal.

It was surmised that if the letter spacings were not changed the color and reflectorization reversal on the new signs might have a significant effect on night legibility. Furthermore, a recent laboratory study [1] had shown that white reflectorized letters on a black background may improve in legibility if the letter spacing is somewhat wider than that used with black on white. No definitive research looking toward the establishment of optimum spacings between letters had been conducted under actual roadway driving conditions.

The present study, therefore, was initiated to investigate the effect on nighttime legibility of increasing the spacing between white reflectorized letters on a black background.

Study Conditions

The study site was a bituminous-surfaced parking lot, 1,500 feet in length, substantially level and unused at night. The area was without illumination except for a few fixed street lights in the distant background. Thus the conditions were similar to those found on unlighted urban freeways or rural highways near cities.

Studies were conducted during March and April of 1955. Observations began after dark and continued until 11 p.m. or midnight. Generally, the weather was fair and no moon was present, although some data for 4 of the 36 observers were recorded during a light rain, and the observations of 2 others were recorded in the presence of a quarter moon. The light rain and moonlight had no apparent effect on the results obtained.

Observers were 36 male employees of the Bureau of Public Roads and of the District of Columbia Department of Vehicles and Traffic. They ranged in age from the middle twenties to the late sixties, and 20 wore eyeglasses. The participants were chosen largely because of their willingness to work in the evening hours, rather than for any particular physical ability or characteristic.

All but 2 of the 36 observers drove one of three 1951 model Pontiacs. A fourth Pontiac, 4 years older, was used by the remaining observers. The test vehicles were equipped with the improved "50-40" sealed-beam headlamps to simulate the best possible visual conditions. The headlamps were checked periodically for proper aim. The new "50-40" headlamps are now legal in all States and all vehicles in production are being equipped with them.

A test panel, 6 feet long by 4 feet high, was mounted at one end of the parking lot with the lower edge 4½ feet above the pavement. Space was provided for two 4-letter words placed one above the other with a 10-inch clearance between lines. Individual letters 10 inches in height were combined to form the test words. Because individual letters were used on the panel, the spacing between letters could easily be varied to suit the requirements of each observation. Narrow guide strips were placed below the words to indicate the letter position for each test condition. The guide strips were not reflectorized or visible during the test runs.

Scope of Study

Three different alphabet designs were observed. Figure 1 shows the word NAVY displayed in each alphabet.

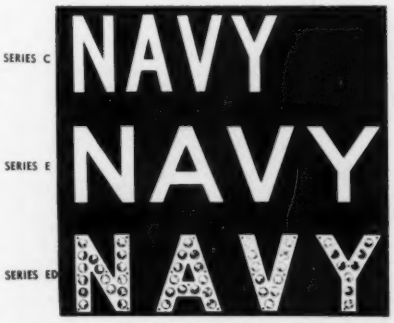


FIGURE 1
Comparison of Series C, E, and ED alphabets at normal spacing.

[1] *Analysis of certain variables related to sign legibility* by H. W. Case, J. L. Michael, G. E. Mount, and R. Brenner. Highway Research Board, Bulletin 60, 1952, pp. 44-58.

TABLE 1
Character (letter or numeral) width and normal spacing of 10-inch Series C and E standard alphabets and 10-inch Series ED (manufacturer's alphabet).

Character	Standard alphabets				Manufacturer's alphabet		
	Character width		Edge code [2]		Character width of series ED [3]	Margin spacing	
	Series C [1]	Series E [1]	Left	Right		Left	Right
	Inches	*Inches*			*Inches*	*Inches*	*Inches*
A	6.25	10.00	III	III	9.00	1.1	1.2
B	5.47	7.97	I	II	7.38	2.2	1.5
C	5.47	7.97	II	III	7.38	1.2	1.4
D	5.47	7.97	I	II	7.38	2.2	1.3
E	5.00	7.34	I	III	6.75	2.2	1.4
F	5.00	7.34	I	III	6.75	2.2	1.0
G	5.47	7.97	II	II	7.38	1.2	1.4
H	5.47	7.97	I	I	7.38	2.2	2.3
I	1.41	1.72	I	I	2.12	2.2	2.3
J	5.00	7.50	III	I	6.75	.8	2.3
K	5.47	8.12	I	III	7.62	2.2	.9
L	5.00	7.34	I	III	6.75	2.2	.9
M	6.48	9.22	I	I	8.50	2.2	2.3
N	5.47	7.97	I	I	7.38	2.2	2.3
O	5.78	8.28	II	II	7.62	1.2	1.3
P	5.47	7.97	I	II	7.38	2.2	1.3
Q	5.78	8.28	II	II	7.62	1.2	1.3
R	5.47	7.97	I	II	7.38	2.2	1.3
S	5.47	7.97	II	II	7.38	1.2	1.1
T	5.00	7.34	III	III	6.75	.9	1.0
U	5.47	7.97	I	I	7.38	2.2	2.3
V	6.09	9.06	III	III	8.12	1.1	1.2
W	7.50	10.47	III	III	9.38	1.1	1.2
X	5.86	8.59	III	III	7.62	1.1	1.2
Y	6.25	10.00	III	III	9.00	1.0	1.1
Z	5.47	7.97	III	III	7.38	2.0	2.1
1	2.03	2.97	I	I	3.12	2.0	2.3
2	5.47	7.97	II	II	7.38	1.2	1.1
3	5.47	7.97	III	II	7.38	1.3	1.5
4	6.09	9.22	III	III	8.25	1.2	2.0
5	5.47	7.97	I	II	7.38	1.1	1.2
6	5.47	7.97	II	II	7.38	1.3	1.2
7	5.47	7.97	III	III	7.38	.9	1.0
8	5.47	7.97	II	II	7.38	1.2	1.3
9	5.47	7.97	II	II	7.38	1.2	1.3
0	5.78	8.28	II	II	7.62	1.2	1.3

[1] Stroke width for Series C, 1.41 inches; Series E, 1.72 inches.
[2] Edge codes determined, with minor exceptions, as follows: Code I indicates side of character has vertical outline; code II, curved outline; and code III, diagonal or open-faced outline. For measurements and sample calculations, see tables 2-3.
[3] Stroke width for Series ED, 2.12 inches. Reflectors measure 1¼ inches in diameter.

Series C and Series E alphabets, 10 inches in height, were chosen because they are representative of those commonly appearing on highway destination signs. These two alphabets were cut from reflective sheeting. The sheeting employed reflects nearly as much light at 20- or 30-degree angles of incidence as it does head on.

In a third alphabet, identified in this study as Series ED, 1¼-inch-diameter plastic reflectors formed the 10-inch high letters. The brightness of these units was considerably greater than the sheeting used for the Series C and E alphabets. The Series E alphabet was quite similar in form to the Series ED, which was designed by a manufacturer.

TABLE 2
Normal spacing between 10-inch letters of alphabets with combinations of codes I, II, and III for adjacent edges.

Examples of letter combinations	Edge code combinations	Letter spacing [1]	
		Series C	Series E
		Inches	*Inches*
HI, JL	I-I	2.11	2.58
NO, PB	I-II or II-I		
NA, FL	I-III or III-I		
GO, RC	II-II	1.69	2.06
ST, ZO	II-III or III-II		
FT, LA, VY	III-III, not parallel	1.12	1.37
EX, LT, WA	III-III, parallel	.56	.68

[1] Measured horizontally between nearest points.

All three alphabets were made from materials with retrodirective properties; i.e., a tendency to reflect a large portion of the light back to the source regardless of the angle of the incident light. The sheeting from which Series C and E alphabets were cut is composed of minute glass spheres, while the plastic units used for the Series ED alphabet develop their reflection from the interior corners of cubes.

From each of the three alphabets, six test words were composed—BALK, FARM, NAVY, STOP, ZONE, and DUCK. These six words use 19 of 26 letters in the alphabet and have a variety of letter forms adjoining each other.

Each of the six words was displayed in three alphabet designs and four different spacings for each of the 36 observers. The base or normal spacing was determined by using the Bureau of Public Roads' spacing chart for Series C and E alphabets and the manufacturer's recommendations in the case of Series ED. These values are shown in tables 1 and 2. A sample calculation for determining the length of a word with normal spacing is given in table 3. To increase interletter spacings, word lengths 20, 40, and 60 percent greater than normal were chosen and the individual letters were arranged within that length to produce a satisfactory appearance.

The 72 combinations of alphabets, words, and spacings were displayed on the panel two at a time. The two combinations used for each panel were changed at the halfway point in the test. In this manner, each combination of alphabet, word, and spacing appeared one half of the time with a word and spacing combination from each of the other two alphabets. The panel displays were systematically chosen so that each word appeared two or three times with every other word. The order of panel presentation was initially selected at random for each half of the test runs, and then the order was advanced for each observer so that each alphabet, word, and spacing combination was shown about the same

TABLE 3
Sample calculation for determining length of the word NAVY in 10-inch letters of the Series E and ED alphabets with normal spacing.

Letter	Width of letters	Edge code		Margin spacing		Combination of codes for adjacent edges	Spacing between letters	Length of word
		Left	Right	Left	Right			
SOLUTION FOR SERIES E								
N	*Inches* 7.97	I	I	*Inches*	*Inches*	I-III	*Inches* 2.06	*Inches*
A	10.00	III	III			III-III, parallel	.68	
V	9.06	III	III			III-III, not parallel	1.37	
Y	10.00	III	III					
Total	37.03						4.11	41.14
SOLUTION FOR SERIES ED								
N	7.38			2.2	2.3		3.4	
A	9.00			1.1	1.2		2.3	
V	8.12			1.1	1.2		2.2	
Y	9.00			1.0	1.1			
Total	33.50						7.9	41.4

number of times in the upper position on the panel as in the lower position.

In short, each combination of alphabet, word, and spacing received as favorable treatment as any other, and the 36 observers read the 72 combinations in conformance with a plan designed to minimize every foreseeable bias. This resulted in a total of 2,592 balanced observations.

In addition to the 72 combinations that were displayed two at a time, the 24 combinations of the Series E alphabet were displayed one at a time for 29 of the 36 observers. Only 6 of the 24 combinations were displayed for any single observer, however.

Figure 2 illustrates a partial breakdown of the 2,592 observations. For the 10-inch Series E alphabet, 216 of the 864 observations were made at each of four different word lengths. The same breakdown was used for Series C and ED alphabets. Similar procedures were followed for each succeeding subgrouping of the total observations.

Visual acuity for each observer was determined from his test results for all three alphabets and six words at normal spacing. The mean legibility distance for these 18 combinations was the visual acuity score for a given observer. All 36 observers were ranked according to their visual acuity scores and then divided into three visual acuity groups of 12 observers each. This grouping was used in analyzing the effect of visual acuity on legibility.

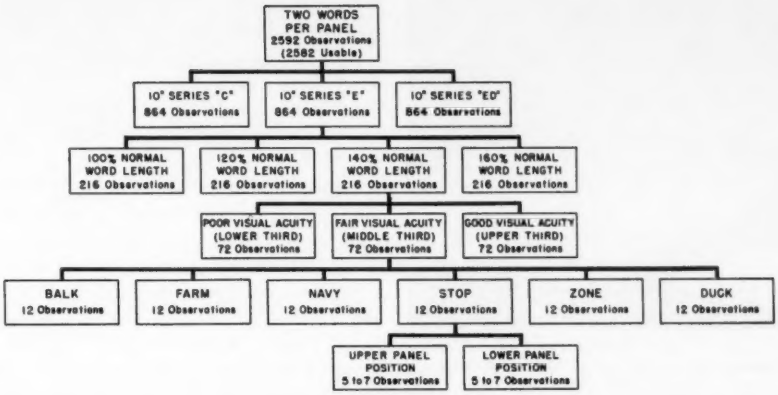

TWO WORDS PER PANEL 2592 Observations (2562 Usable)
10" SERIES "C" 864 Observations
10" SERIES "E" 864 Observations
10" SERIES "ED" 864 Observations
100% NORMAL WORD LENGTH 216 Observations
120% NORMAL WORD LENGTH 216 Observations
140% NORMAL WORD LENGTH 216 Observations
160% NORMAL WORD LENGTH 216 Observations
POOR VISUAL ACUITY (LOWER THIRD) 72 Observations
FAIR VISUAL ACUITY (MIDDLE THIRD) 72 Observations
GOOD VISUAL ACUITY (UPPER THIRD) 72 Observations
BALK 12 Observations
FARM 12 Observations
NAVY 12 Observations
STOP 12 Observations
ZONE 12 Observations
DUCK 12 Observations
UPPER PANEL POSITION 5 to 7 Observations
LOWER PANEL POSITION 5 to 7 Observations

FIGURE 2
Number of observations for each alphabet, spacing, visual acuity group, word, and panel position.

Conclusions

The following conclusions may be drawn for the nighttime legibility of 10-inch white reflectorized letters on a dark, nonreflectorized background under simulated roadway conditions, and with low beam of the headlamps:

1. Definite improvements in legibility result from moderate increases above the spacings normally used between sign letters. If inter-letter spacings are increased until the word length is 40 percent greater than normal, the mean legibility distance increases 15 percent above normal for the Series C alphabet, 16 percent for Series E, and 7 percent for Series ED.

2. An increase of approximately 40 percent over the normal word length is about the limit for realizing additional legibility through greater interletter spacing. Words lengthened more than 40 percent above normal gain little or nothing in legibility; with Series E and ED alphabets, word legibility actually declines and the increase with Series C is only slight.

3. Mean legibility distances recorded for the 36 observers were 478 feet for the Series C alphabet, 596 feet for Series E, and 614 feet for Series ED—all measured at normal letter spacing. The 15-percentile values ranged from 27 to 33 percent lower, being 350, 400, and 450 feet for Series C, E, and ED alphabets, respectively.

4. Words formed with the Series ED alphabet have slightly superior legibility in comparison with the Series E alphabet when word lengths are normal or no more than 10 percent in excess of normal. At wider letter spacoings, the Series E alphabet is more legible. Letter design details and reflectent charactaristics both differed between the Series E and ED alphabets, but an evaluation of the independent contributions of these two factors to legibility was beyond the scope of this study.

5. Legibility distances for words formed with the Series E alphabet are 118 to 142 feet greater than for Series C at the various spacings. The Series C alphabet, however, occupies less word length for a given spacing, and on the basis of legibility distance per inch of word length, it is somewhat superior to Series E. The two alphabets are equally legible when displayed at corresponding spacings and when letters of the Series E alphabet are reduced in height so that the legend areas are the same.

6. A display of two words rather than one on a sign tends to reduce the distance at which any single element of the message is legible. Additional words on the sign would reduce legibility further.

7. The responses of observers grouped according to their visual acuity are similar. Legibility curves determined for these groups, though of a different magnitude, follow remarkably consistent patterns.

8. A change from 5 to 7 feet in the vertical position of a sign legend above the roadway has little effect on the legibility distance.

9. More consideration of sign proportions is warranted in the development of sign design. Where vertical dimensions are restricted and dictate the use of letter heights less than those desirable, increased word lengths can help to compensate for the loss of legibility distance that would otherwise occur.

10. Within the limitations of appearance and need for emphasis, the horizontal spacings between sign letters should more commonly be increased to take advantage of portions of the sign area otherwise unused.

Test Procedure

Each observer was instructed to drive along the course at an estimated speed of 30 miles per hour, but to focus his attention on the sign panel rather than on the speedometer. He was shown a typewritten list of the six test words before the test began, but was not informed of their order of presentation or about details of alphabet and spacing. Normally, two cars made test runs in close sequence—beginning at one end of the course some 1,500 feet from the sign panel. The first driver was allowed to proceed 600 to 900 feet along the course before the second driver started in order to minimize interfer-

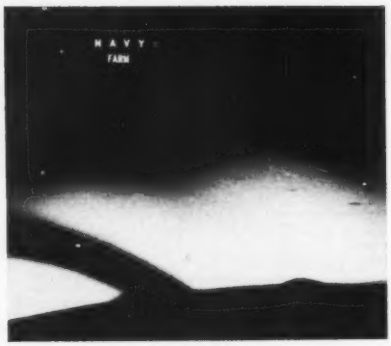


FIGURE 3
Appearance of sign panel from a distance of 200 feet.

ence in the legibility observations. The driver made the observations and a recorder sat in the rear seat. No one else was in the car and all runs were made using low beam of the headlamps.

As soon as the driver-observer could read either of the two words, he called it aloud, and the recorder noted the distance from the panel to the nearest 25 feet by referencing his position to coded markings on the course. Similarly, the second word was read as soon as legible and the distance recorded. After both words had been read, the observers continued past the sign panel and drove back to the beginning of the course. Two new words were then placed on the panel. During each circuit of the course, which consumed about 2½ minutes, each observer usually saw the headlamps of the other car although not while actually reading the signs. Thus the effect of light from intermittent opposing headlamps on the eye was introduced to a limited extent, but care was taken to avoid any direct glare.

Observers were instructed to drive so that the left edge of the car was in line with a row of parking stall markings. This resulted in a simulated vehicle placement in the center of a 12-foot lane with the near edge of the sign panel 6 feet from the right shoulder.

FIGURE 4
Closeup view of the sign panel.

The instructions discouraged guessing by observers and few combinations were read incorrectly. At times it was possible to expose the incorrectly read combinations for a second observation, and as a result only 10 observations of the 2,592 were not usable.

Figure 3 shows the words NAVY and FARM from the observer position in a car 200 feet from the sign panel. The stall markings that served as a guide for the observers are dimly visible at the left. Beside the left curb, coded course markers spaced 50 feet apart were used by the recorder to identify the point at which the observer read each combination.

Figure 4 is a closeup view of the panel. NAVY is formed with letters of the Series ED alphabet at the widest spacing (word length, 60 percent greater than normal). FARM is formed using letters of the Series C alphabet at normal spacing.

Legibility Distances Determined

For each of the 36 observers, an average legibility distance was calculated from all 72 observations. These values varied from less than 300 to nearly 900 feet, a ratio of over three to one. Figure 5 shows this relation. Over two-thirds of the observers had average values between 500 and 800 feet, but the distribution was somewhat skewed in the lower direction with one-ninth of the observers having average distances below 400 feet. When highway signs are designed, the capabilities of drivers with poor visual acuity deserve special consideration. Observers wearing glasses did not perform quite as well as a group as those without glasses.

Word Lengths Increased

For all three alphabets, increasing the spacing first produced greater legibility, then a leveling off or an actual decrease in legibility occurred, as shown by figure 6.

The mean legibility distance for the narrow Series C alphabet at normal spacing was 478 feet. Legibility increased to 549 feet at word lengths 40 percent greater than normal, but the 60-percent increase in word length resulted in only 5 feet more of legibility distance.

The wider Series E alphabet produced a mean legibility distance of 596 feet at normal spacing. A 40-percent increase in word length resulted in a mean legibility distance of 691 feet, while the 60-percent increase in word

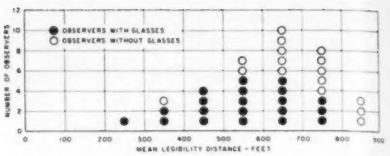


FIGURE 5
Observations of 36 different observers distributed according to the mean legibility distances.

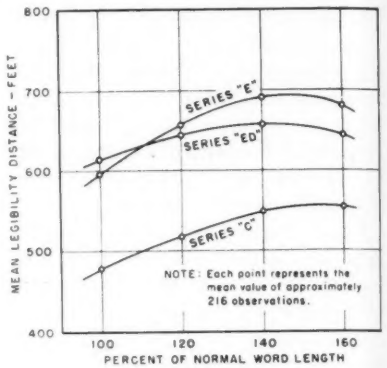

MEAN LEGIBILITY DISTANCE – FEET
SERIES "E"
SERIES "ED"
SERIES "C"
NOTE: Each point represents the mean value of approximately 216 observations.
PERCENT OF NORMAL WORD LENGTH

FIGURE 6
Legibility distances for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

length actually reduced the legibility distance by 10 feet.

For the Series ED alphabet, similar in form to the Series E but of a different reflectorizing material, the mean legibility distance was 614 feet at normal spacing. Legibility increased to 657 feet at word lengths 40 percent greater than normal, but the 60-percent increase in word length resulted in a 13-foot decrease in the mean legibility distance.

As figure 6 clearly shows, Series E and Series ED alphabets should not be displayed at word lengths that are much more than 40 percent greater than 40 percent greater than normal, for at these wider spacings an actual decrease in legibility resulted. Little was gained by displaying the Series C alphabet at spacings beyond the 40-percent point.

The percentage increases in legibility with increased spacing were nearly identical for Series C and Series E alphabets, as shown by figure 7. An in-

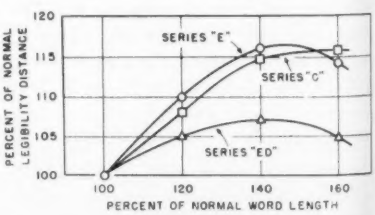


FIGURE 7
Percentage change in legibility distances for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

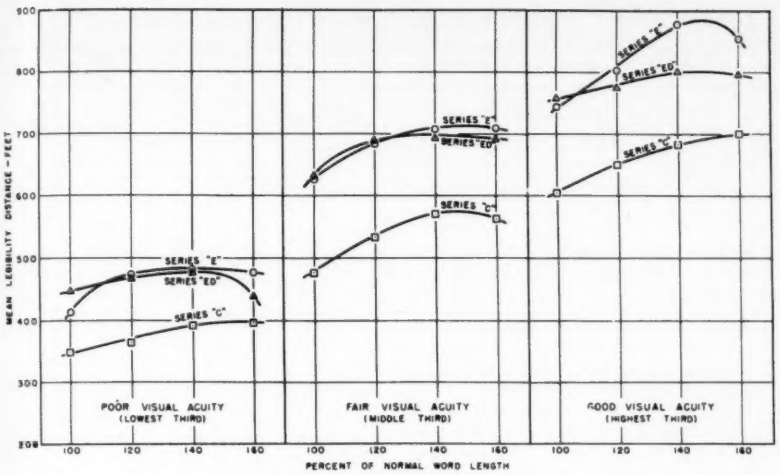


FIGURE 8
Legibility distances, according to visual acuity groups, for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

crease in word length of 40 percent over normal increased legibility, 15 percent for Series C, and 16 percent for Series E, but only 7 percent for Series ED.

Effect of Visual Acuity

As noted earlier, highway signs should be designed for the driver with poor vision rather than for the average driver. The data were analyzed to determine whether drivers with poor, fair, and good eyesight showed similar and proportionate changes in their legibility patterns as letter spacings were increased.

Figure 8 shows mean legibility distances for each of the three visual acuity groups. In the case of the Series C alphabet, mean legibility distances for the poor visual acuity group were at least 250 feet below those of the good visual acuity group. For Series E and Series ED alphabets, the differences between the poor visual acuity group and the good group were over 300 feet. In general the patterns of legibility were similar for all groups.

These relations are shown on a percentage basis in figure 9. A 40-percent increase in word length resulted in a 12-percent increase in legibility of the Series C alphabet for the poor visual acuity group, 19 percent for the fair group, and 13 percent for the good group. For the Series E alphabet, percentage increases for the three groups were 17, 13, and 18 percent, respectively; while for Series ED the percentages were 6, 9, and 5 percent, respectively. The poor visual acuity group was within one percent of the average value for all three groups combined for Series E and ED alphabets, and within 3 percent for Series C. Because of this close agreement and the fact that relative values only are of principal importance in much of this study, the three groups were combined for most of the analysis.

After combining all visual acuity groups, the lower 15-percentile legibility distances at normal spacing were 350 feet for Series C, 400 feet for Series E, and 450 feet for Series ED. This compared closely with the mean legibility distances for the poor visual actuity group of 351, 414, and 449 feet, respectively.

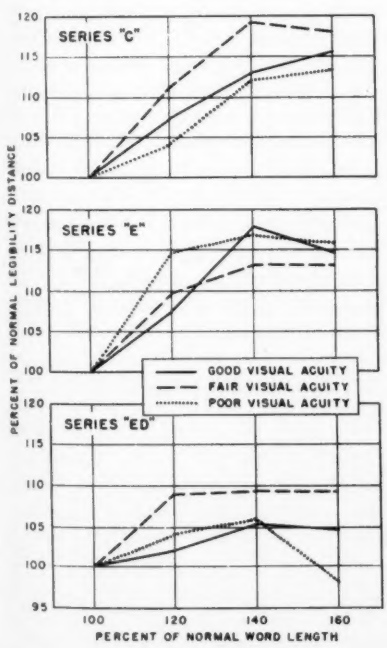


FIGURE 9
Percentage change in legibility distances, according to visual acuity groups, for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

One and Two Words Per Panel Compared

When two words are placed on a single panel, each can have some effect on the legibility of the other. The 174 observations of words formed with the Series E alphabet and placed on the panel one at a time give a general indication of this effect, as shown by figure 10. The number of observations of "one word per panel" for a given visual acuity group and spacing was not the same. To correct for this, equal weight was given to each visual acuity group and spacing regardless of the number of observations within each category.

As the corrected curve in figure 10 shows, observations made with only one word per panel resulted in legibility distances ranging from 46 to 123 feet greater than for two words per panel. When only one word at a time was displayed, legibility showed a more rapid gain as spacing was increased, and continued to improve beyond the 40-percent increase in word length.

Legibility of Six Test Words Varies

Of the six words tested, STOP was consistently read at the greatest distance. Undoubtedly, this was due in part to the familiarity of this word to the average driver because of its use

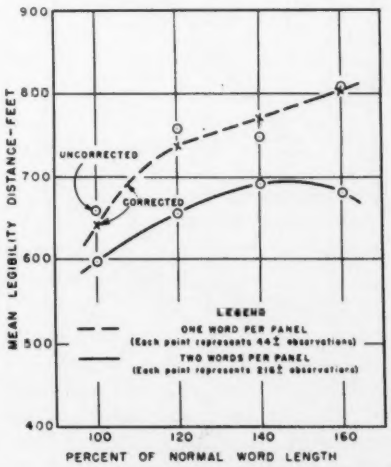


FIGURE 10
Legibility distance, according to the number of words displayed on panel, for Series E alphabet as affected by the spacing between letters in test words.

TABLE 4
Legibility distances for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

Test word	Mean legibility distance—feet														
	Series C alphabet					Series E alphabet					Series ED alphabet				
	Normal word length	Word length increased by—			Average, all word lengths	Normal word length	Word length increased by—			Average, all word lengths	Normal word length	Word length increased by—			Average, all word lengths
		20 percent	40 percent	60 percent			20 percent	40 percent	60 percent			20 percent	40 percent	60 percent	
STOP	526	564	644	634	592	638	710	753	734	709	661	706	699	680	686
NAVY	487	519	547	541	523	602	649	716	706	668	622	682	655	670	657
ZONE	480	515	559	558	528	568	651	666	666	638	629	689	674	629	655
DUCK	470	512	512	534	507	596	659	682	698	659	576	601	606	669	628
FARM	465	519	549	557	522	576	648	712	665	650	616	611	612	575	603
BALK	442	471	484	502	475	595	614	620	619	612	579	578	634	639	607
Average	478	517	549	554	---	596	655	691	681	---	614	645	657	644	---

on the standard STOP sign. In addition, the letters are so arranged that a rather distinctive open shape results.

In the case of the Series C alphabet, BALK was the least legible at all spacings. The remaining words had about the same legibility, with DUCK slightly below the rest as shown in table 4. DUCK and BALK have somewhat similar shapes and the difficulty of distinguishing between them may have accounted for their diminished legibility. BALK was also near the bottom in legibility for both Series E and Series ED alphabets as shown in the table, while DUCK was slightly above average for Series E and slightly below average for Series ED.

Figure 11 shows the percentage increase in legibility of individual words with an increase in word length. The Series C alphabet had the most consistent pattern for the six words and Series ED, the most erratic pattern; the word F A R M in letters of the Series ED alphabet actually showed a decrease in legibility as spacing increased.

Effect of Panel Position

The upper or lower position on the panel had little effect on legibility as shown by figure 12. Series C and E alphabets were both more legible when placed on the lower portion of the panel, approximately 5 feet above the roadway surface. The Series ED alphabet was more legible in the upper position, which was roughly 7 feet above the roadway surface. The average difference in legibility was generally less than 20 feet for any one of the three alphabet series, and has no significant implications for sign designers.

A possible explanation for the difference in legibility of words in the two panel positions is that the Series ED alphabet is made from a material with greater apparent reflectance than optimum for the low-beam illumination and other conditions of the test, while Series C and Series E alphabets are made from materials with less apparent reflectance than the optimum. Thus the upper panel position for the Series ED alphabet may in this case be better than the lower one because it receives less incident light from the headlamps and the apparent reflectance is less. With Series C and Series E alphabets the converse applies.

Comparison of Series E and ED Alphabets

One of the more interesting comparisons made involves the relative legibility values obtained with the Series E and ED alphabets. These were of similar design, except that the Series E alphabet was cut from reflective sheeting, and Series ED was constructed of plastic reflector units. As figure 6 and table 4 show, at normal spacing the Series ED alphabet was legible 18 feet farther than the Series E, while at word lengths 20 percent greater than normal, the legibility distance for Series ED was 10 feet less than Series E, and at word lengths 40 and 60 percent above normal, the legibility distances for Series ED were 34 and 37 feet less, respectively.

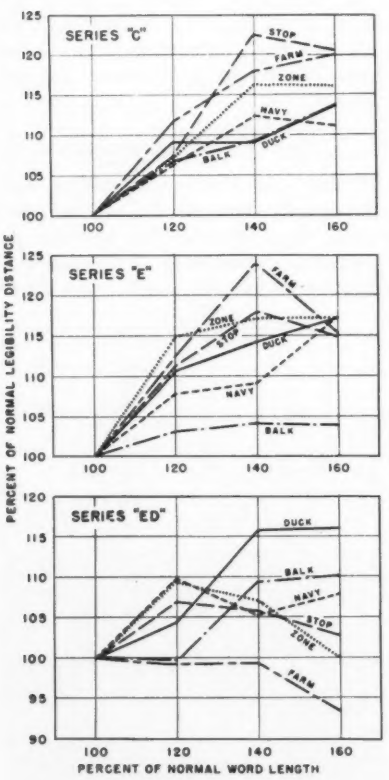


FIGURE 11
Percentage change in legibility distances for each test word of Series C, E, and ED alphabets, as affected by the spacing between letters in test words.

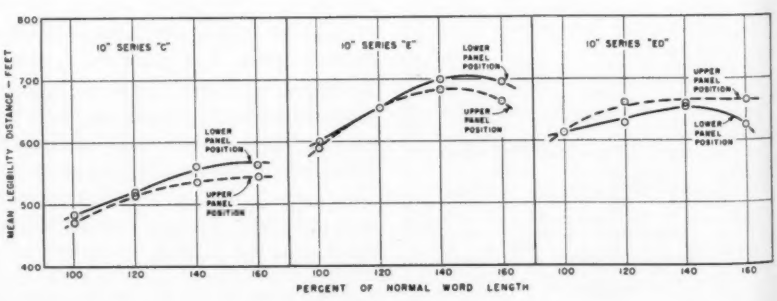


FIGURE 12
Legibility distances, according to panel position, for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

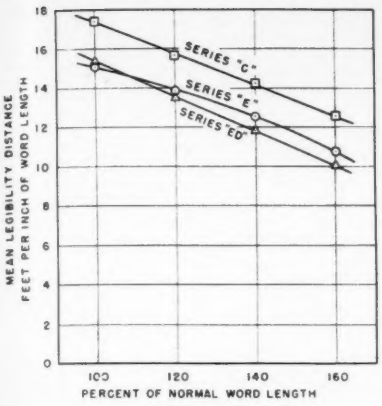


FIGURE 13

Legibility distances (in feet per inch of word length) for Series C, E, and ED alphabets as affected by the spacing between letters in test words.

A characteristic of the letter design in the Series ED alphabet is that it results in slightly greater word lengths than those of standard Series E. Figure 13 shows the mean legibility distance expressed in terms of feet of legibility distance per inch of word length. This tends to equalize the minor differences in word length between the two alphabets. Again the Series ED alphabet is superior at normal spacing and Series E at the wider spacings. The highest values, obtained with the Series C alphabet, are discussed later.

In the final analysis, the most useful value for comparative purposes is the height of letters of the Series E alphabet that results in a legend area per letter equal to Series ED at each of the four spacings. In order to obtain this, it was first necessary to know how the legibility of Series E changed with letter height.

A study reported by Forbes et al.[2] contains data that make possible this determination. That study used a white Series E alphabet on a black background. Night observations were made by individuals on foot and the signs were artificially illuminated. The spacing between letters was greater than the normal spacing of the present study and, in addition, the stroke width was about 16 percent greater than the standard. If the six words used in the present study had been similarly composed, the word lengths would have been 11 percent greater than normal.

The median legibility distances for 8-and 12-inch capital letters forming "place names with knowledge" were 690 feet and 1,060 feet, respectively. Thus, in this range of letter height, each inch increased the legibility distance an average of 92½ feet, and the calculated legibility of a 10-inch letter is 875 feet. In the present study, the corresponding median value was 640 feet, and the mean legibility distance was 630 feet.

The differences in results arise from several factors, principal among which are the driving observers, the display of two words per panel, and perception-reaction requirements. These factors are additive in their effect and help to account for the differences in legibility distances recorded. Because the results of these parallel studies are reasonably comparable, it is feasible to demonstrate the relative effects that letter height and spacing have on sign design.

The incremental value of 92½ feet per inch of letter height was derived from a word length 11 percent greater than normal in the present study. Proportionate ratios were computed for other word lengths, and these ratios were used to determine mean legibility distances of words formed with the Series E alphabet and measuring above and below 10 inches in height.

For equal legend area per letter, a 10.05-inch letter of the Series E alphabet is equivalent to a 10-inch letter of the Series ED alphabet at corresponding spacings. At normal spacing the legibility of the 10-inch Series ED alphabet is 14 feet greater than the 10.05-inch Series E, while at word lengths 20, 40, and 60 percent greater than normal, the Series ED alphabet has 15, 39, and 42 feet less legibility.

Comparison of Series C and E Alphabets

As figure 6 shows, the Series E alphabet has an advantage over Series C of between 118 and 142 feet in legibility distance at the various spacings. The Series E alphabet occupies considerably more sign area, however, and if mean legibility distance per inch of word length is considered, Series C has the advantage as shown by figure 13.

Of greater interest, perhaps, is the resulting legibility when the two alphabets occupy equal legend area per letter and are displayed at the same relative spacing. A letter of the Series E alphabet, 8.34 inches high, occupies he same legend area as a 10-inch letter of the Series C alphabet at corresponding spacings. The mean legibility distances for the 8.34-inch letter height were calculated using the procedure outlined earlier.

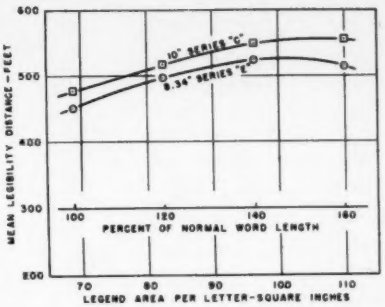

10" SERIES "C"
8.34" SERIES "E"
MEAN LEGIBILITY DISTANCE - FEET
PERCENT OF NORMAL WORD LENGTH
LEGEND AREA PER LETTER-SQUARE INCHES

FIGURE 14

Legibility distances for Series C and E alphabets (letters adjusted in height to produce equal legend areas) as affected by the spacing between letters in test words.

The results of this calculation are shown in figure 14. It is seen that the Series C alphabet has an advantage over the Series E when legend area is taken into account. The differences are small, however, and since the curves were derived from two separate studies, a fairer statement would be that Series C and Series E alphabets are equally efficient users of sign space.

In a recent revision of the Manual on Uniform Traffic Control Devices,[3] it was recommended that the letters of the narrower Series A and B alphabets not be used for reflectorized signs. The present study, however, indicates that Series C, next in width, has no disadvantage when compared with the wider Series E alphabet. It is conceivable, therefore, that at least for night legibility of white reflectorized letters on a dark background, letters even narrower than Series C may also be as efficient as Series E. This finding may or may not hold for daytime viewing.

The effect of irradiation or spreading of the stroke width of white reflectorized letters may account for the close agreement in legibility of the 10-inch Series C and 8.34-inch Series E alphabets. A narrower stroke width for Series E might produce improved night legibility.

To obtain with letters of the Series C alphabet a legibility distance equivalent to that of Series E at comparable spacings, a greater letter height must be used. Words formed with the 10-inch Series C alphabet are only about as legible as those formed with the

2 *A comparison of lower case and capital letters for highway signs* by T. W. Forbes, Karl Moskowitz, and Glen Morgan. Proceedings of the Highway Research Board, vol. 30, 1950, pp. 355-373.

3 *Revisions to the manual on uniform traffic control devices for streets and highways*, Bureau of Public Roads, 1954, p. 1.

8½-inch Series E alphabet. The legibility equivalent of a 10-inch Series E alphabet would be a Series C alphabet about 12 inches high. An obvious feature of this relation is the saving in the vertical dimension of a sign where short, wide letters are used in place of tall, narrow letters.

Alternative Methods of Improving Legibility

It has been shown that for a given alphabet, additional spacing between letters will increase legibility. The question still remains, however, as to whether legibility should be increased in this fashion or by increasing the letter height.

Again by use of the data contained in the Forbes study,[4] it is possible to compare the two alternatives, as in figure 15. Here it may be seen that a word, formed with 10-inch letters of the Series E alphabet with spacing 20 percent greater than normal, occupies about the same legend area per letter as a word with 11-inch letters at normal spacing, but gives slightly less legibility. An increase of 40 percent in word length increases the legibility distance somewhat less in proportion to that attainable by increasing the letter height. Beyond 40 percent, of course, legibility declines rapidly; thus the use of these wider letter spacings is undesirable.

In general, it is desirable that the initial sign layout be made at normal spacing, using the width of alphabet and letter height required for the legibility desired. In the development of a final design, the opportunity to introduce additional interletter spacing can often be used to advantage. Where two or more lines of sign copy are to be used, one line seldom fills the entire sign width. Increased spacing may be used for this line, thus increasing legibility with no increase in the size of sign panel required. For signs on overhead structures or for overhead signs at other locations, the vertical dimension of the sign may be limited and a comparatively small letter height may be required. In such instances, the common practice has been to shrink the total dimensions. Actually, the widest practicable alphabet (Series E or even the widest standard alphabet, Series F) and up to 40 percent more word length can be utilized to good advantage. Similarly, where the horizontal sign dimensions are restricted, letters of the narrower Series C alphabet can be employed at normal spacing, and legibility increased by using a greater letter height.

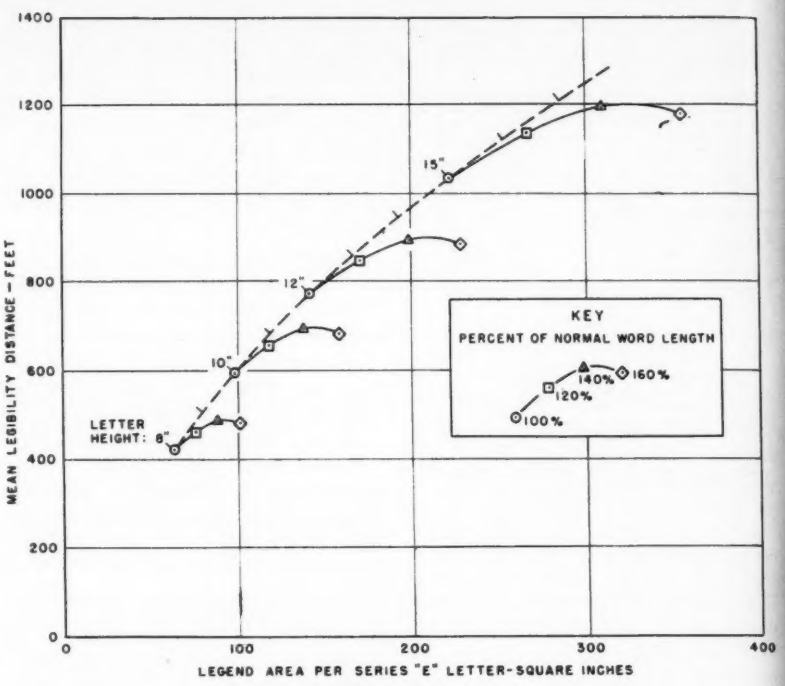


FIGURE 15
Legibility distances for Series E alphabet as affected by the height of letters and the spacing between letters in test words.

Application of Test Results

A sign found near many cities having large airports is AIRPORT, NEXT RIGHT. Figure 16 shows a possible design for such a sign. Series C and E alphabets are used with letters 12 inches high and normally spaced. These would probably be the desired proportions under normal conditions for a ground sign where adequate distance is available for advance warning and the average running speed is about 50 miles per hour.

With expressways handling heavy volumes of traffic, overhead signs are often necessary. Vertical clearances might be restricted if the sign were placed on an overhead structure. In that event, the sign could be stretched out as shown in figure 17. The vertical dimension then is reduced from 4 to 3 feet, and the horizontal dimension increased from 8 to 10 feet.

AIRPORT is comprised of letters of the Series F alphabet, 10 inches high, and the spacing is increased so that the word length is 40 percent greater than normal. This results in a word that has substantially the same legibility as the ground sign, which had 12-inch letters of the Series E alphabet and normal spacing. Similarly, NEXT RIGHT uses 10-inch letters of the Series E alphabet at a word length 20 percent greater than normal. The resulting legibility is better than could be obtained from the ground sign, which had 12-inch letters of the Series C alphabet and normal spacing.

FIGURE 16
Typical ground sign with 12-inch letters and normal spacing.

FIGURE 17
Overhead sign with 10-inch letters and extended spacing.

4 See footnote 2. p. 119.

On every G-E Controller you get

Fewer components, jack mounting, for easy, economical maintenance

Signal interval accessories for every need

1. Actuated timer for spasmodic left turns against traffic.

2. Non-actuated timer for consistent left turns.

3. Pedestrian-actuated timer for extending green intervals.

4. Synchronizer to coordinate controller in single-cycle system.

5. Minor movement timer for separate actuated movement.

6. Double-phase, extra-interval timer.

7. Single-phase, extra-interval timer.

General Electric's new traffic control line has been designed with an eye to *extra* easy maintenance. That means a lot less service time . . . and significant savings in service dollars.

HERE'S WHY G. E.'s new line is a maintenance man's favorite: First, it has fewer components and consequently fewer things that might go wrong. Then too, fewer components make the trouble easier to spot. Second, a new type of jack mounting, standard on G-E traffic controller models, makes repairs no more difficult than changing a radio tube. And, speaking of tubes, you can buy standard replacements at your nearest radio store . . . no waiting for special units to be shipped from a factory.

FOR FULL INFORMATION on these new controllers and accessories, contact your authorized G-E traffic distributor or Apparatus Sales Office, or write Section 453-70, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Recognizing and Realistically Planning for Large City Transportation Growth

by E. E. Kearns

Manager, Urban Transit Sales
Locomotive and Car Equipment Department
General Electric Company, Erie, Pa.

BUSINESS LEADERS and public officials are coming more and more rapidly to recognize the large growth in the transportation of goods and people during the last 15 years. We have experienced growth not only because of some 25 percent increase in population, but also because we are moving more ton miles of goods per capita and are traveling many more miles each year. In fact, goods movement and travel during this 15 year period have expanded some three times as fast as the population. Here are some key comparisons: Ton miles hauled have increased over 80 percent, passenger miles traveled have increased some 65 percent, and automotive vehicle registrations have increased 75 percent.

Much of this breath-taking growth since 1940 has been taken well in stride by our railroads, open highways, airplanes, ships and pipe lines. In fact, *except for city transportation*, this great increase has been handled smoothly and with substantial improvements in speed, conveniece and efficiency.

In and about our cities, however, the impact of this great transportation demand is literally swamping us. The speed, convenience and efficiency of movement is rapidly deteriorating — in fact conditions are becoming virtually chaotic in many instances. Estimated losses resulting from congestion, confined almost entirely to our cities and their approach highways, run into billions of dollars annually.

Sound improvement of urban transportation services ranks among the foremost of our national needs. A realistic approach to the provision of this sustaining lifeblood—urban movement—is to recognize the fundamental necessity of moving people and goods speedily, conveniently, comfortably, safely and at reasonable cost. A deterrent to the solution of this problem is the fact that thinking in recent years has been largely in terms of moving vehicles rather than moving people and goods. We have been forlornly trying to move and store in our highly developed urban areas an ever increasing avalanche of vehicles rather than to develop sound coordinated use of all of our transportation tools, each where it should and can best serve. Students of this problem are coming to recognize the necessity of approach along the following lines to realistically provide for the ever increasing transportation demand.

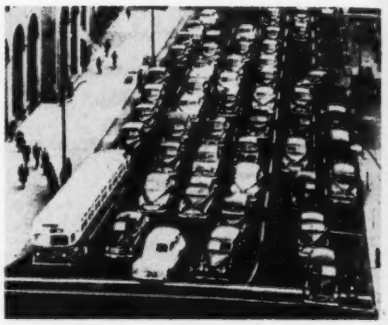


Figure 2
One transit vehicle carries as many people as the automobiles in this block—a graphic illustration of the importance of planning in terms of moving people rather than vehicles.

Figure 1
The rapid increase of transportation in major urban areas has swamped facilities considered adequate only a few years ago.

1. Give major attention to by-passing justified "*through*" commercial and private automotive traffic thus keeping it out of highly-developed congested areas.

2. Provide maximum practical off street loading and unloading facilities for trucks and commercial vehicles. Where these facilities are impractical, regulate the timing of loading and unloading in the congested areas to off peak hours.

Figure 3
An important factor in providing for the ever increasing traffic demand is to establish an area-wide coordinated public transportation system that will attract more patonage.

3. Increase coordination of truck and railroad freight traffic, particularly for long-haul movements.

4. Continue application of all modern traffic engineering techniques with the view to moving "*necessary*" traffic — primarily "*justified*" commercial and private autos—more efficiently.

5. Thoroughly plan and locate new developments generating major movements of people and goods including industries, terminals, commercial, office, and recreational areas with full coordination of transportation therewith.

6. And last, but by far not least, provide an area-coordinated public transportation service that will attract more people.

This last phase is the only one which will be dealt with more fully here in order to produce some provocative thoughts that may help to kindle accelerated attention. Area-coordinated public transportation progress can contribute greatly toward meeting the rapidly rising demands of urban transportation. Here are some relationships which seem to be the key to this whole problem.

First, consider a surface transit route, say the Clark-Wentworth service of the Chicago Transit Authority. Durfrequency of service is provided, and ing the maximum hours a one minute approximately 9,000 passengers per hour are carried in and out of the Loop. To carry this same number of people in automobiles would require three streets with two open traffic lanes in each direction.

Now consider the potential of the new Congress Street freeway. With four automotive lanes in each direction it can move—with average automobile occupancy—a maximum of about 8000 to 9000 passengers per hour in the direction of heavy travel. Just two tracks of rapid transit on this project can move 40,000 passengers per hour, and installation of the additional two tracks can double this capacity. In other words, the four lanes of rapid transit provide an increase in potential artery capacity equal to the automotive lanes of 10 such expressways. Of very particular interest in this connection is the fact that the incremental cost of the Congress Expressway project amounted to less than 5 percent to provide the additional width for the rapid transit tracks.

While these relative lane capacities and costs tell a great deal about how to cope with soaring transportation demands, some specifics pertaining to parking area requirements tell still more.

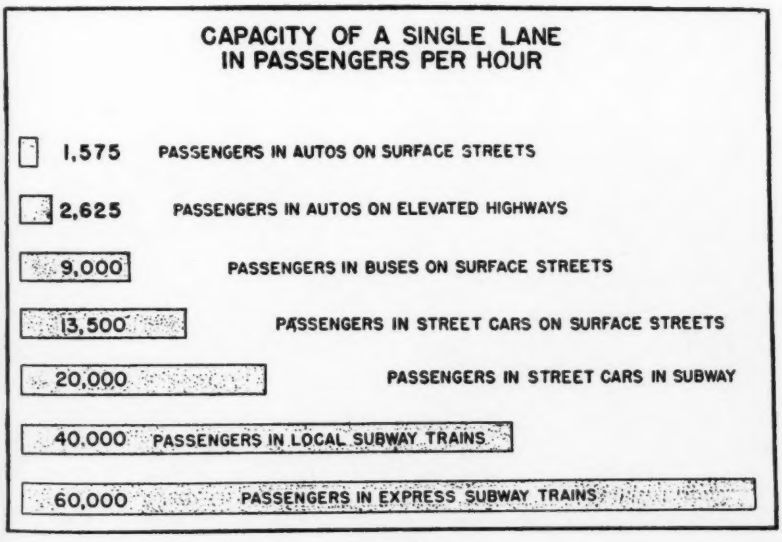


Figure 4
Relative passenger carrying capacities of various means of transportation.

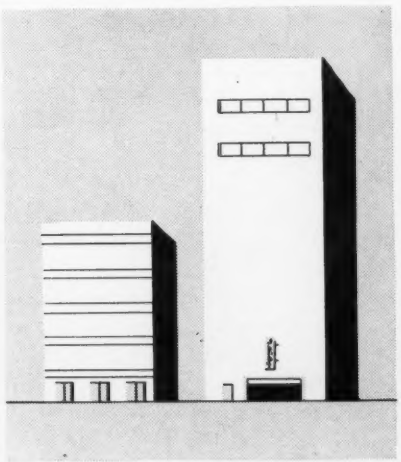


Figure 5
For the average mix of modern office and merchandising operation, about two square feet of parking area is required per square foot of business area if all workers and customers travel via private automobile.

Recently an eminent Eastern traffic engineer was called upon to develop the ratio of automobile parking area to business floor area needed to serve a modern business center of merchandising and office buildings. After thorough studies, he concluded that to serve such a business area with automobiles alone would require twice as much parking area as the total "*floor*" area of the business buildings! He said twice the "floor" area, not twice the ground area, of the business buildings! This tremendous parking area requirement has recently been stated in another way. Figured in terms of today's average curb parking space, it requires parking all the way around nine city blocks just to serve the workers on the ground floor of *one* city block; and more parking space is required to take care of customers! The manager of a large merchandising operation stated recently that they own 25 percent more parking area adjacent to their store than the total floor area of the store. They find that on peak days they must prohibit employee parking because they need all this parking space just for their customers!

These specifics of lane capacities to move people and of great areas required to park automobiles quickly point up the paramount importance of attracting more people to public transit.

Urban travelers can be divided into four categories: (a) The "must" driver, i.e., the commercial vehicle or auto driver, who must drive his truck or automobile to transact his business. This includes deliverymen, doctors, salesmen, etc. (b) The "preference" driver, i.e., the motorist who drives because he finds this mode of travel faster and more convenient. (c) The "must" rider of public transit, i.e., the traveler who has no other choice. (d) The "preference" rider who finds public transit superior to driving in congested traffic and parking in expensive lots and garages. The prime challenge to greatly increase urban transportation capacity lies in attracting many people from the preference driver class into the preference rider class. This needs to be done in the traditional American sense; that is, by providing public transportation to and within the highly developed urban areas offering speed, convenience, and attractiveness that will merit patronage by free choice. A sound coordinated team of the modern auto and public transportation must be developed—with the auto serving the "must" driver and acting as a feeder to public transportation in the non-congested suburban areas.

Figure 6
Fast, convenient and comfortable public transit is a potent factor in converting "preference" drivers into "preference" riders.

To attain this goal, the combination service must be made supremely attractive.

The public transit service must be fast—

1. Insofar as practical, transit must be provided upon private rights-of-way free from cross traffic, and upon exclusive lanes on regular streets.

2. Number of stopping points must be reduced to a minimum, recognizing that comparisons will be made with thru driving, including driving on modern expressways and boulevards.

3. Transfers must be kept to a minimum with public transportation services coordinated on a metropolitan,

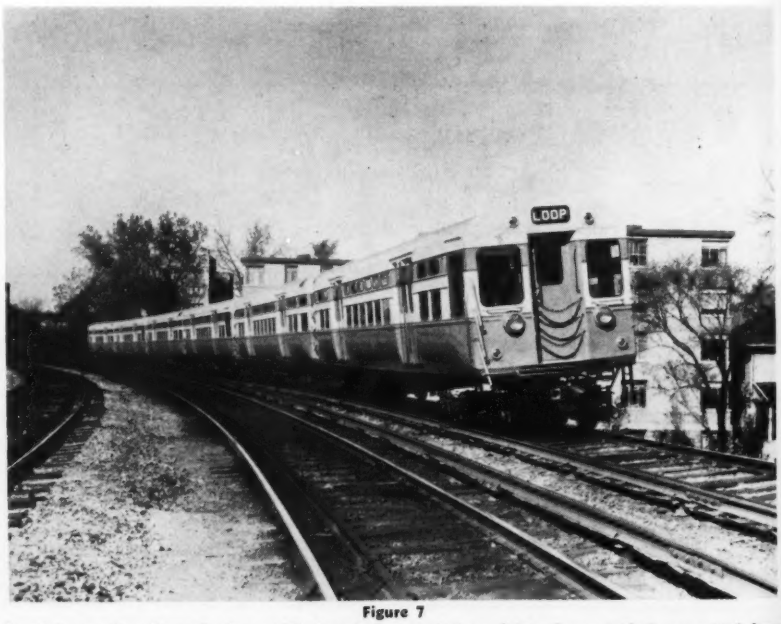


Figure 7
Speed is greatly enhanced when public transit is operated on rights-of-way entirely separated from other traffic.

Figure 8
Abundant and convenient parking space is a major consideration in making public transit attractive to the average automobile driver.

Figure 9
In order to compete with automobile travel time, public transit must be operated with modern vehicles capable of maintaining high schedule speeds.

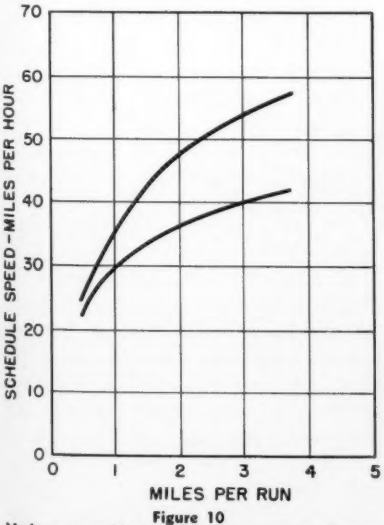


Figure 10
Modern propulsion equipment, capable of sustained acceleration and high running speeds, shows increasing advantage in schedule speed as distance between stops is increased.

practical speeds, and fast smooth braking should be used. A good example of this progress is the development recently undertaken by the Chicago Transit Authority with Transit Research Corporation and the manufacturers. Recently developed propulsion equipment and trucks have substantially increased rapid transit car performance. Sustained accelerating ability permits trains such as the pilot models being tested to attain 40 MPH in 15 seconds as against 40 MPH in 40 seconds for the "Green Hornet" trains. Such increased performance will save some 20 to 30 seconds for each mile operated and will permit rapid transit services of the type contemplated for the Congress Expressway to be operated with five less trains.

Service must be convenient, comfortable, and attractive—

1. Seats must be provided insofar as practical, particularly for the longer rapid transit and commuter trips.

2. Vehicles must be attractive, well air-conditioned and lighted, quiet, and clean.

3. Stations should be attractive, comfortable, clean, well policed, and designed to permit rapid loading, unloading and transfer. Shelter should be furnished, if possible, where stations are not practical.

4. Escalators should be provided at heavy volume stations where consider-

area-wide basis. Necessary transfers must be easy and require a minimum of time.

4. Abundant, convenient automobile parking space must be provided at outlying stations to allow easy coordinated use of the auto and public transportation.

5. Modern rolling stock capable of fast sustained acceleration, maximum

Figure 11
Stations should be convenient, attractive, well maintained, and planned for maximum efficiency in handling passengers.

Figure 12
The use of various types of trasportation vehicles should be coordinated so that each operates in the area where it is most efficient.

Figure 13
Public transportation must be removed from the glue of traffic congestion by maximum use of exclusive lanes on city streets and private rights-of-way wherever possible.

able difference in grade level must be negotiated. Stairs and ramps should be kept attractive, well lighted and clean.

Service must be safe and fares reasonable.

Of all public transportation elements, speed, convenience and attractiveness are the key requirements if preference drivers are to be converted into preference riders. Speed, or saving in travel time, is by far the most important of these three. In considering this element, all factors making up total travel time must be seriously studied. These include time to get to and from the services, waiting time, and time consumed in transfers. Delays due to traffic, unnecessary stops—either scheduled or sporadic—and slow performance compared with alternate modes of travel are highly distracting.

The thoughts developed here that will be of prime significance to traffic and transportation engineers who understand the importance of good transportation are these:

I. Think in terms of moving people and goods rather than vehicles. Even with the best coordination of the various transportation media, the volume of "*necessary*" vehicles to be handled will be greater than we can cope with.

II. Implement the use of each type of transportation vehicle where it can best serve, enhancing auto driving for feeder service in non-congested suburbs, and high-volume public transportation in highly-developed congested areas.

(Continued on page 151)

Moving Vehicle Method of Estimating Traffic Volumes

by R. C. Blensly (Assoc. Mem., ITE)
Planning Survey Engineer
Oregon State Highway Department

A METHOD OF ESTIMATING traffic volumes by the moving car method was explained in considerable detail in a report by the Cook County (Illinois) Highway Department entitled "Moving Vehicle Method of Estimating Traffic Volumes and Speeds," published in TRAFFIC ENGINEERING for September 1956. Prior to that, the method had been reported by the Institute of Civil Engineers (London) in a report entitled "A Method of Estimating Speeds and Flow of Traffic From a Moving Vehicle." The method as proposed in these two publications was developed primarily for use in urban and suburban areas where relatively high traffic volumes are normally encountered.

The traffic counting program in Oregon for the years 1956 and 1957 will obtain vehicle mile information on the streets of all incorporated cities in the state. The moving vehicle method appeared to offer a very easy method of obtaining this information. Therefore, tests were conducted in Salem (population 43,140) and Jefferson (population 636) to determine the accuracy which might be expected from this method.

The moving vehicle method employs an automobile which travels over the network of streets for which traffic volumes are to be determined. The driver and/or an observer records the time expended in traveling the selected route, the number of vehicles which are met which are traveling in the opposite direction and the number of vehicles traveling in the same direction which either pass or overtake the study vehicle. The information is then expanded to represent the average daily traffic by the formula:

TABLE I

COMPARISON OF MOTOR VEHICLE MILES FROM MOVING VEHICLE METHOD AND AUTOMATIC RECORDER COUNTS

		Daily Vehicle Miles			Per Cent Error	
		Moving Vehicle Method	Recorder Counts Partial Coverage	Recorder Counts Full Coverage	Moving Vehicle Method	Recorder Partial Coverage
SALEM	Miles					
Route 1	0.97	430	-	380	+ 14	-
Route 2	0.88	270	-	140	+ 94	-
Route 3	1.62	1020	-	690	+ 47	-
Route 4	0.58	0	-	40	- 100	-
Total	4.05	1720	-	1250	+ 38	-
JEFFERSON						
Route 1	2.22	400	-	670	- 40	-
Route 2	1.46	480	-	1140	- 58	-
Route 3	1.58	1070	-	940	+ 6	-
Total	5.26	1950	2850	275.0	- 29	+ 4

TABLE II

Salem, Oregon
Jefferson Street
East of Baker Street
(Residential)

Date (1956)	Day of Week	24 Hr. Volume	10 AM - 3 PM Volume	Expansion Factor Mon.	Tue.	Wed.	Thur.	Fri.
January 4	Wed.	162	44			3.68		
5	Thur.	152	37				4.11	
6	Fri.	181	41					4.41
9	Mon.	131	40	3.28				
10	Tue.	149	38		3.92			
11	Wed.	139	35			3.97		
12	Thur.	117	25				4.68	
13	Fri.	152	39					3.90
16	Mon.	147	31	4.74				
17	Tue.	186	46		4.04			
18	Wed.	172	50			3.44		
19	Thur.	116	26				4.46	
20	Fri.	141	41					3.44
23	Mon.	155	52	2.98				
24	Tues.	154	36		4.28			
25	Wed.	154	50			3.08		
26	Thur.	119	29				4.10	
27	Fri.	110	35					3.14
30	Mon.	147	42	3.50				
31	Tue.	145	38		3.82			
February 1	Wed.	154	42			3.67		
2	Thur.	139	30				4.63	
3	Fri.	159	45					3.53
6	Mon.	163	45	3.62				
7	Tue.	150	42		3.57			
8	Wed.	149	45			3.31		
9	Thur.	139	35				3.97	
10	Fri.	175	55					3.18
13	Mon.	132	44	3.00				
Average		148	40			3.70		

Two Standard Deviations = ± 1.02

$$V = K \frac{M + (O - P)}{t}$$

V = estimated volume during period of study

K = the minutes during period of study, normally 10 A.M. to 3 P.M.

M = the vehicles met

O = the vehicles overtaking an observers vehicle

P = the vehicles passed by observers vehicle

t = time in minutes elapsed traversing the route.

The normal period recommended for conducting the moving vehicle method is from 10:00 A.M. to 3:00 P.M. on a weekday. This period will generally represent approximately one-fourth of the average daily traffic, and will have approximately an equal distribution of traffic volumes by hours. If these traffic flow patterns are normal for the area under study, the observation runs can be made at any time during this period. If, however, very large variations occur such as an unusually high or low volume from 12:00 noon to 1:00 P.M., it might be well to exclude this period from the study or to be sure that observations are made during this period in addition to observations during the remainder of the study period. The volume determined for the study period can be expanded to an average daily traffic by the use of control stations to establish the relationship of the study period to the ADT. The results of this method provides traffic volumes for sections rather than fixed locations.

In December 1954, complete coverage by mechanical counters was obtained for selected sections of Salem. Availability of these traffic volume counts for each block led to the selection of Salem as an area to test the moving vehicle method in February, 1956. Because of the time differential between the recorder counts and the moving vehicle method, an additional area for study was felt desirable, so the City of Jefferson which was relatively small and close at hand was selected. In Jefferson full coverage (adjusted to compensate for moving car) was obtained with mechanical recorders at the same time the moving vehicle method was conducted. The results of the daily vehicle miles computed by the two methods in Salem and Jefferson are shown in Table I.

From this table it will be noted that the percentage error based upon the full coverage recorder counts representing the true vehicle miles was +38 per cent in Salem and — 29 per cent in Jefferson. In both cities the area studied was broken into routes. The error by routes in Salem was + 14 per cent for Route 1, + 94 per cent for Route 2, + 47 per cent for Route 3, and — 100 per cent for Route 4. In Jefferson the errors by routes were — 40 per cent for Route 1, — 58 per cent for Route 2, and + 6 per cent for Route 3. These results indicate that very large errors may result using relatively short routes, and that the error can be reduced to some extent by combining the routes. The over-all error in both areas, however, does not indicate compared to the moving vehicle that the moving vehicle method is satisfactory in low volume areas.

On Figure 1 are shown the streets comprising each of the four routes studied in Salem. In addition, the December, 1954, 24-hour traffic volumes on these streets are shown. Both Salem areas were confined to strictly residential development, and arterials adjacent thereto were not included in the study. For Routes 1 and 2 the residential areas were well developed and experienced practically no growth through the addition of new homes. Routes 3 and 4, on the other hand, are in a relatively new subdivision which is still developing rather rapidly. The use of 1954 traffic volumes

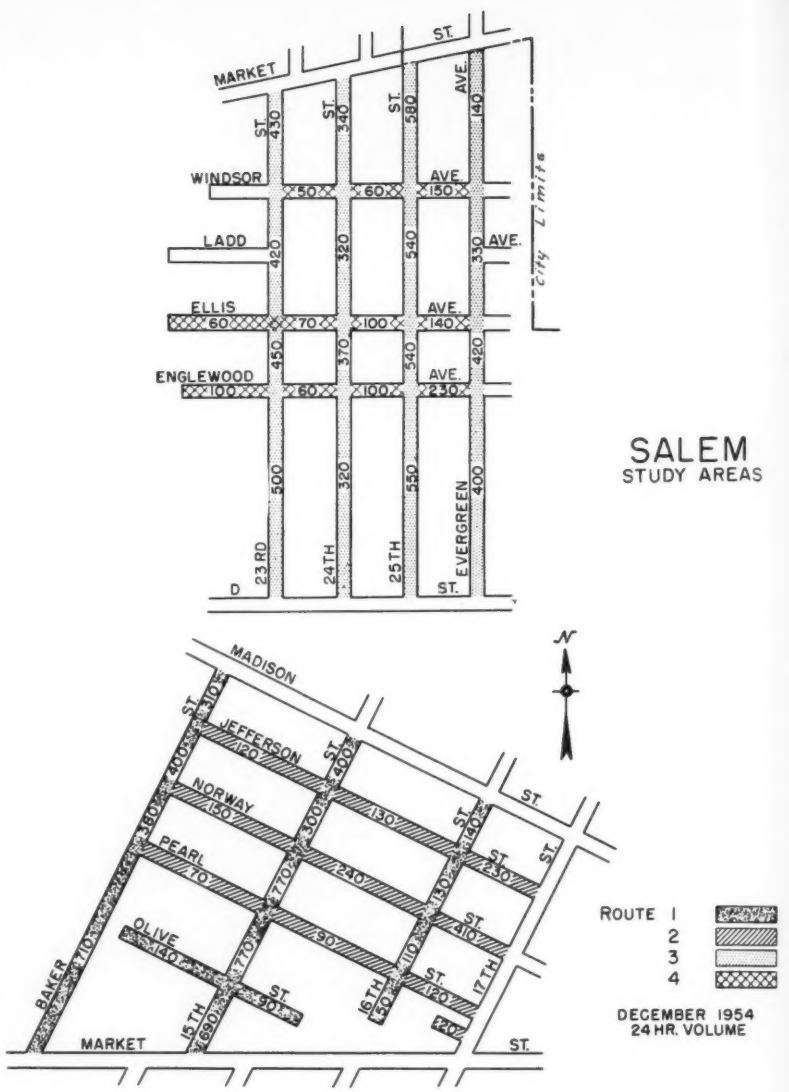


FIGURE 1

method should yield for Routes 3 and 4 higher vehicle miles than from the machine counts. For Routes 1 and 2, a nominal annual growth would be expected. A review of Table I, however, does not verify these expectations.

The moving vehicle method was conducted for the areas in Salem during a period of 10:00 A.M. to 3:00 P.M., and the observing vehicle traversed the routes constantly during that time, moving from one route to the next. During the study all observations were made traveling in the same direction so that no compensation was made for uneven flows of traffic by direction. This may account for some of the error in Salem.

As part of the urban traffic counting program, control stations have been established in urban areas throughout the state. Tables II and III show data for control stations in Salem on a residential street and on an arterial street. The residential control station is located on Route 2. These tables show for the period of January 2 through February 13, the relationship of the 10:00 A.M. to 3:00 P.M. traffic volume to the 24-hour volume. It will be noted that on the residential street this relationship has a fairly large variation and deviations from the mean larger than 27 per cent may be expected five times out of 100. This would indicate that operation of a control station at the same time that the moving vehicle method is being used would be desirable. For arterial streets, the deviations are much less and probably would not require the operation of the control station at the same time the moving vehicle method is used. However, care should be exercised to avoid unusual conditions.

Figure 2 shows the routes used for the moving vehicle method in Jefferson and the March, 1956, 24-hour volume counts obtained with machine recorders. The volume counts which would normally be used for partial coverage have been indicated. In Jefferson all streets were included in the moving vehicle method, however, no attempt was made to determine traffic volumes separately by functional systems. The routes were laid out so that the observer could travel both directions on all routes with a minimum of inconvenience and overlapping. As a matter of convenience it was possible to lay out the routes so that one complete trip could be made without any interruptions of the running time except those possible stops required at intersections to yield the right of way. Because of the low volumes encountered on most of the streets, these stops were rare occurrences. An attempt was made to cover each route at least once in each hour during the period 10:00 A.M. to 3:00 P.M. A control station using a cumulative hourly recorder was located on North Avenue between Second and Third Streets. This control station provided the data necessary for expanding the five-hour volumes to 24-hour volumes. The expansion factor for Jefferson for the day of the study was 2.75.

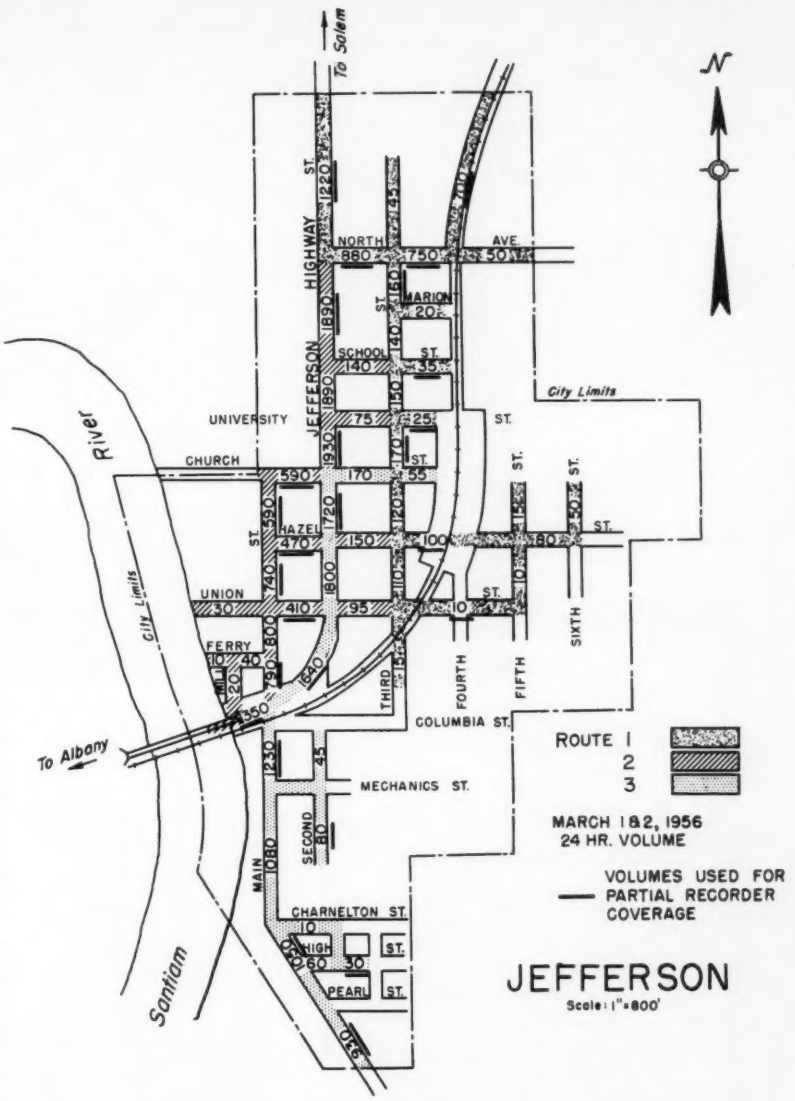


FIGURE 2

Referring to Table I, it would be noted that for individual routes the percentage error by the moving vehicle method was — 40 per cent for Route 1, — 58 per cent for Route 2, and + 6 per cent for Route 3. Route 2 consisted in a large part of arterial and fairly heavy volume streets near the retail sales area. For this reason, the average volume for this route would be expected to be higher than for the other two routes and a minimum error would be anticipated for this route. Actual results, however, are to the contrary, and Route 2 had the largest error.

The Cook County report included equations for determining a sample time necessary to provide data with a selected accuracy for various traffic volumes. The application of these formulae to the tests in Oregon indicated that a total sampling time of 323

(Continued on page 147)

21 reasons why you should use HARBORITE®

for street and highway signs

- ✔ **WATERPROOF**—The original boat hull plywood with 100% waterproof glues. Can't come apart.
- ✔ **WEATHERPROOF**—Bake it, boil it, freeze it—stays like new for years and years.
- ✔ **WON'T CHECK**—Smooth overlay completely hides wood grain. Perfect paint-holding surface.
- ✔ **RESISTS DENTS**—Tough surface and solid wood absorbs worst punishment.
- ✔ **WON'T SPLIT**—No matter what the weather, stays solid, smooth.
- ✔ **WON'T BEND**—Vandals can't wrap this material around sign post.
- ✔ **WON'T CRACK**—Take an ax to Harborite—it won't fail.
- ✔ **WON'T RUST**—No rust to shorten sign life.
- ✔ **RESISTS VANDALISM**—Frustrates vandals' bullets, rocks and bottles.
- ✔ **HEAT, COLD-RESISTANT**—Won't warp or change dimension in extreme climate changes.
- ✔ **STIFF, FLAT**—The perfect surface for silk screening.
- ✔ **GREAT STRENGTH**—Pound for pound, stronger than steel.
- ✔ **LIGHTWEIGHT**—Easy to store, handle and erect.
- ✔ **PERFECT PAINTABILITY**—Less paint absorption. Better, more economical paint surface.
- ✔ **EASY TO WORK**—Cuts into any shape with ordinary wood tools.
- ✔ **LESS FRAMING NEEDED**—Inherent structural strength reduces bulky, expensive framing.
- ✔ **LARGE SIZE**—Standard 4′ x 8′; extra length solid panels to 12′; oversized scarfed panels available on special order.
- ✔ **CHOICE OF THICKNESS**—From $^5/_{16}$″ to $1^1/_4$″.
- ✔ **MODERATE COST**—Extra sign life and durability reduce cost to rock bottom.
- ✔ **RE-USES**—High salvage value proved by major users.
- ✔ **LONG LIFE**—Actual cases of 8 yrs. outdoor use with no breakdown. Potential life unlimited.

HARBORITE IS UNMATCHED BECAUSE OF EXTRA CARE IN MANUFACTURE:

NO TROUBLE-MAKING CORE GAPS TO REPAIR!
Solid cores . . . always! Every nail or screw bites into solid wood.

WEARS LONGER! HOLDS PAINT BETTER!
Harborite's extra tough surface is harder than most medium density surfaces.

CAN'T COME APART UNDER ANY CONDITIONS!
100% waterproof glue, originally developed by Harbor for boats, seals Harborite forever!

©1956, Harbor Plywood Corporation

sales offices and warehouse stocks in:

ABERDEEN
ATLANTA
CHICAGO
CINCINNATI
HOUSTON
INDIANAPOLIS
JACKSONVILLE
LOS ANGELES
SAN FRANCISCO
SEATTLE
TAMPA
Other Major Cities.

SIGNS MADE OF HARBORITE LAST LONGER...

LOOK BETTER...COST LESS IN THE LONG RUN!

This miracle overlaid fir plywood...super-resistant to wear, weather and water ...now available in unlimited quantities! The core of this panel is famous Super-Harbord ...all solid wood, no hidden flaws. A medium density resin impregnated fiber is fused to the face. The result...a plywood miracle!... super-strong, super-resistant and super-wearing.

HARBOR
PLYWOOD CORPORATION
Aberdeen, Washington

...makers of the Royal Family of Plywoods...

Tests prove Harborite superior to other sign materials!

Exhaustive tests conducted by the Technical Department of the Douglas Fir Plywood Association prove conclusively that overlaid plywood is far superior to other materials for outdoor signs and displays. Signs tested were made of fir plywoods, overlaid plywood, steel, aluminum and glass fiber. These findings have been further backed by state and municipal government tests throughout the country. (Copies of the official test results are available.)

Now! Harborite competitive in price with marine type fir plywoods!

write for free literature and the name of your nearest Harborite dealer...

HARBOR PLYWOOD CORPORATION
Aberdeen, Washington 12-TE

Check One or Both:

☐ **Please send copy of Douglas Fir Plywood Association test booklet.**

☐ **Please forward sample of Harborite and additional information.**

Name_____

Address_____

City_____ Zone____ State_____

Firm Name_____

Roadside Interviewing on Lake Shore Drive

By Louis E. Keefer
(Jun. Mem., ITE)
Traffic Engineer, Chicago Area Transportation Study

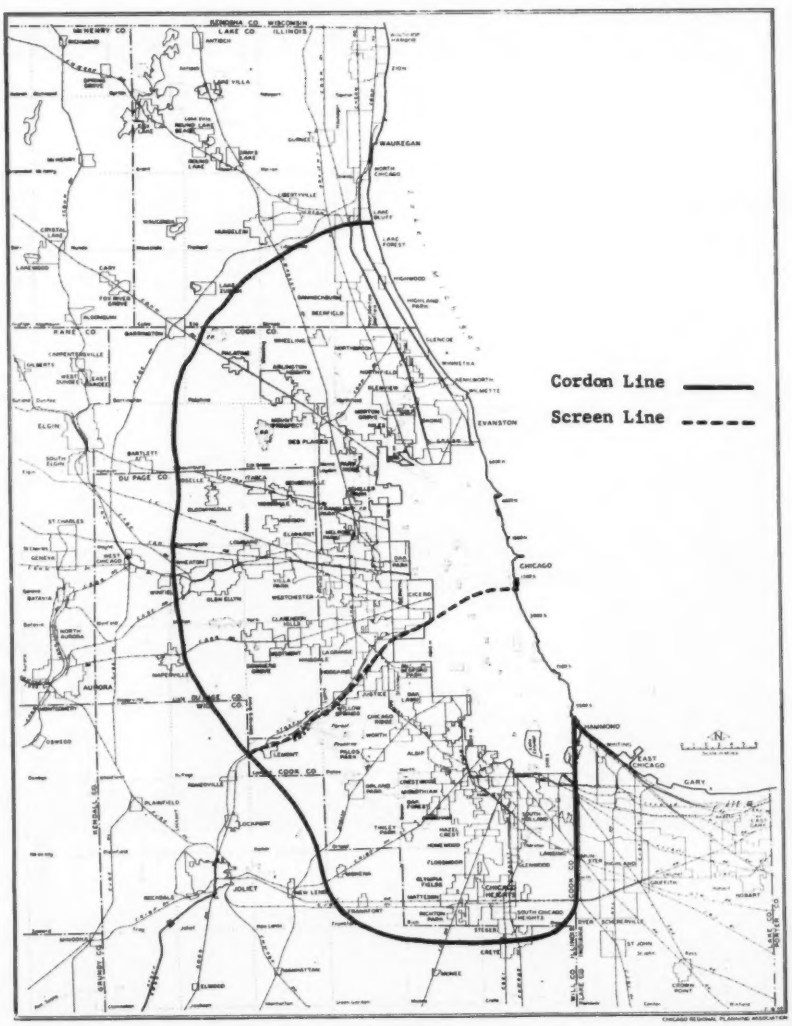
The Chicago Area Transportation Study is by far the most comprehensive origin and destination survey ever attempted. It is a three-year research project sponsored by the United States Government, the State of Illinois, the County of Cook, and the City of Chicago. The result will be a complete inventory of the movement of people by all modes of transportation — except air and water—within a 1,250 square mile study area, a projection of this movement into the future, and a recommendation of the optimum transportation system required to accommodate this movement.

The Roadside Interview Survey

The roadside interview survey was one of the several surveys which make up the Chicago Area Transportation Study. It was a companion to the home interview, the truck-taxi, and the mass transit surveys, and the first of these to be finished. By interviewing approximately one-out-of-four vehicle drivers crossing the cordon line defining the study area, and approximately one-out-of-five crossing the screen line bisecting the study area, two major purposes were served. First, information was obtained to be used to test the accuracy and completeness of the other surveys; and second, information was obtained for travel unaccounted for by the other surveys. In most O-D surveys, of course, only classification counts are taken at the screen line. In the Chicago Area Transportation Study, interviewing on the screen line provided a wealth of information which will be used in a series of important checks and comparisons with the other surveys.

Interview stations were established on the cordon line on those roads which, in the aggregate, carry 95 per cent of the total highway travel into and out of the study area. There were 53 such stations, of which 28 were operated for 24 hours, and 25 for 16 hours. Interview stations were established on all roads crossing the screen line. There were 33 such stations, of which 27 were operated for 24 hours, and only six for 16 hours. In the total survey, roughly 200,000 interviews were obtained from 880,000 passing drivers.

When stopped for interviewing on the cordon line, the driver was asked his origin, destination, trip purpose,



MAP 1
Chicago Area Transportation Study.

Natecs gives SAFE clearance of intersections . . .

even protects against collisions of two emergency vehicles

In the NATECS system, a receiver mounted on the traffic signal at the intersection picks up a beam from a transmitter mounted on the approaching vehicle. Traffic lights automatically set on the emergency pattern. Then a *white* light turns on, *assuring* the emergency-vehicle driver that the intersection is clear.

If *two* signals are received at an intersection from emergency vehicles approaching from different directions, the white light facing the *second* vehicle flashes on and off, warning that another vehicle has priority.

Operation on radar frequencies permits a *narrow* beam that won't affect any signals but those directly ahead (up to ¼ mile) of the emergency vehicle. Completely automatic. No need to flip a switch as the vehicle changes direction. And after the vehicle passes the intersection, traffic lights automatically revert to normal sequence.

EAGLE

EAGLE SIGNAL CORPORATION
Municipal Division
Moline, Illinois
Eagle equipment saves lives . . . saves time

MAIL COUPON TODAY

EAGLE SIGNAL CORPORATION
Municipal Division, Dept. TE-1256
MOLINE, ILLINOIS

Please send complete information on Eagle's new emergency traffic control system.

NAME AND TITLE _____

MUNICIPALITY _____

FULL ADDRESS _____

the kind of place (or type of establishment—a refinement of land use) at whichever end of the trip was inside the study area, where the vehicle was garaged, his route of entrance or exit (for through trips only), and whether empty or loaded (for trucks only). The interviewer also recorded the type of vehicle, the number of persons in the vehicle, the direction of travel, and other information relating to the time and place of interviewing.

When interviewing on the screen line, the questions pertaining to kind of place and route of entrance or exit were not asked.

The Problem

The screen line is located along an east-west line — as shown in Map 1 — intercepting most of the major north-south streets in the study area. Among these was South Lake Shore Drive—the Outer Drive — in the area of the "near South Side." In this area, the Drive is a divided highway with four, 10-foot travel lanes in each direction. The average weekday traffic, two-way, is approximately 110,000—all passenger cars except for occasional express buses and maintenance trucks. The 8-9 A.M. peak is about 5,500 vehicles northbound, and the 5-6 P.M. peak is about 5,000 vehicles southbound. Average operating speeds are 45 to 50 M.P.H. with a posted limit of 45 M.P.H. These physical and operational characteristics are typical of the section between the 23rd Street and 31st Street grade separations, across which passes the screen line. Figure 1 shows heavy traffic on Lake Shore Drive northbound near Soldier Field.

With such traffic, it was observed that the Drive must operate near the point of critical density during the peak hours. Any stoppage under this condition, such as for roadside interviewing, would tend to progress in a backward wave of stopping and starting—the accordion effect. Repeated stoppages, then, might be expected to back up traffic for many miles. With this in mind, it was decided that interview stations located anywhere between the 23rd Street and 31st Street grade separations would create intolerable congestion and a high degree of hazard. The Traffic Engineering Section of the Chicago Park District, under whose jurisdiction the Drive is operated, agreed with this decision.

The Solution

It was suggested that by the addition and subtraction of the ramp traffic at the 23rd Street grade separation, interview stations could be located as indicated on Map 2 and essentially the same traffic would be interviewed as would have been interviewed at the screen line.

FIGURE 1
Lake Shore Drive Traffic.

Traffic southbound at the screen line (E) is the same as traffic southbound on Columbus Drive (A) plus traffic southbound on South Lake Shore Drive (B) plus traffic southbound to the Drive from 23rd Street (D) minus traffic southbound from the Drive to 23rd Street (C). Conversely, traffic northbound at the screen line (I) is the same as traffic northbound on South Lake Shore (F) plus traffic northbound from the Drive to 23rd Street (H) minus traffic northbound from 23rd Street to the Drive (G). The movements at (J), (K), (L), (M), (N), and (O) are relatively insignificant and will be accounted for by office adjustments.

The Operation

Interview stations, therefore, were located at (A), (B), (D), (F), and (H). Only classification counts were taken at (C) and (G). The 3-11 P.M. interview shift was scheduled for Monday, May 28; the 7 A.M.-3 P.M. shift for Thursday, May 31; and the 11 P.M.-7 A.M. shift for Tuesday, June 4. These dates were dictated by the repaving of Michigan Avenue, lasting throughout the summer, which was certain to have caused considerable diversion to the Drive on any later dates.

The necessary equipment for interviewing was available as a result of other operations already completed. The only additional need was for interviewer personnel. Depending upon the hour of operation, a total of 30 to 42 interviewers proved sufficient at the various locations. Among these were 22 regular interviewers, eight University of Chicago student-interviewers, and 12 Chicago Area Transportation Study office personnel drafted as temporary interviewers. Each was thoroughly briefed in the special techniques to be used in the operation.

Some Special Techniques Required

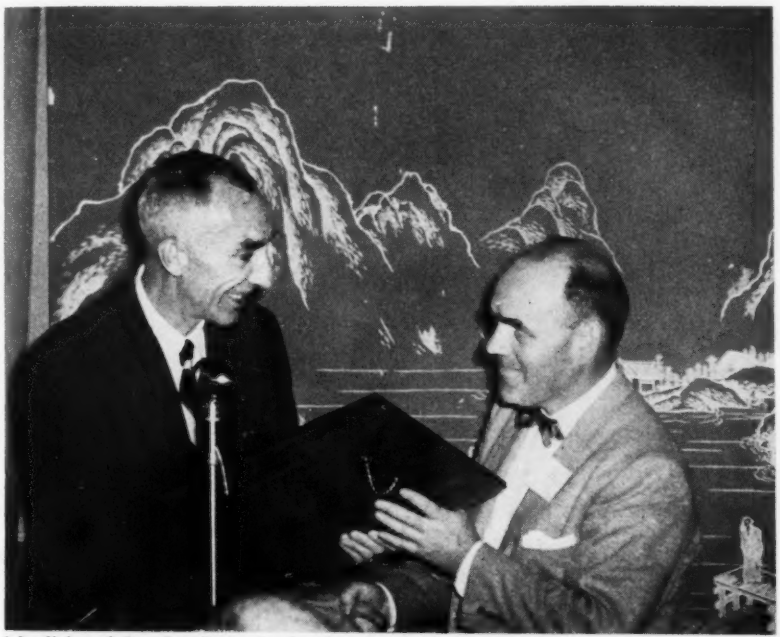
At (A) and (B) it was desired not to interview southbound vehicle drivers leaving the Drive at 23rd Street. Accordingly, at (A) and (B) the first question asked of each driver stopped for the interview was, "Where do you intend to leave the Drive?" If the reply indicated the 23rd Street grade separation, the driver was sent ahead and the notation "23rd Street" was recorded on the interview form. If some other point was indicated, the driver was interviewed in the usual way. Figure 2 shows interviewing in progress along the right curb at (B).

It was assumed that the percentage of southbound vehicles stopped for interview and destined for 23rd Street, was the percentage of all southbound vehicles so destined. The expanded totals of vehicles destined for 23rd Street were then subtracted from the classification counts taken at (A) and (B).

Also subtracted from the classification counts at (A) and (B) were southbound vehicles destined for points between (A) and (B) and 23rd Street

(Continued on page 148)

Institute Affairs



John Hoban, Safety Coordinator for Seattle and assistant to Mayor Clinton, accepts the ITE plaque from F. B. Crandall at banquet of the Governor's Safety Conference.

Pasadena receives its plaque. Left to right: E. F. Granzow, Police Dept.; Douglas C. MacKenzie, City Engineer; J. E. Havenner, Vice President, ITE; and Hon. Warren Dorn, Mayor.

SECRETARY'S COLUMN

The period following the Annual Meeting is somewhat of a let-down as far as accomplishments are concerned. New committees are being appointed and the officers are finding out about their new duties. It is a time for adjustment and orientation.

At headquarters there has been little chance to catch one's breath, however. The magazine deadline is a hard taskmaster. Coupled with that has been preliminary work on the new Proceedings, which it is hoped to have out earlier this year. In addition, work is underway on the new edition of the Yearbook.

The San Francisco meeting left the Executive Secretary with many odd jobs too—mostly for the Board. One about which all members will hear soon is the updating of the Institute's list of consultants. The aid of Burt Sexton (one of our consultants who lives in Washington) has been enlisted in developing a questionnaire and a format for the list.

Not "Too Much, Too Soon"

Many members saw an item in the *Engineering News-Record* early in October which quoted the ITE as saying the new Federal highway program was "too much, too soon." Of course this was not the sense nor the words of the San Francisco meeting—and the editor of the *E-N-R* has been so advised.

There was talk at San Francisco about needs, in terms of studies, manpower, and public support, and this somehow got translated in reporting to mean that we doubted the wisdom of the program. We do not feel that way about it—and we want the world to know it.

Incidentally, the AGC has recently publicized some recommendations of their members to expedite the highway program. While many of their suggestions deal with purely contractor's problems, a couple are of concern to us. One point made by AGC is the need for improved traffic-handling procedure at construction work. Another is the importance of selling the value of the access control features of the Interstate System. Both of these are points in which Institute members can make some contribution.

Miami Meeting Date

The post card ballot on the choice between August and September for the date of the 1958 meeting in Miami was not decisive. About 500 members voted

—almost evenly divided. To resolve the question, the Board of Direction was polled and the week of September 22 was chosen.

Your Secretary's Travels

Your Executive Secretary has been on the go much more since the Annual Meeting. With the office running more smoothly, it is not so difficult to break away.

A portion of the week of October 22 was spent in Chicago at the National Safety Congress. This also afforded a chance to sit down with President McMonagle and Vice President Sielski to discuss ITE affairs. One appearance on the Congress program and three committee meetings (one an all-day affair) occupied the remaining time.

Then the next week there was an appearance before the Traffic Problems Conference at Penn State. A number of Institute members were present, either in the audience or on the platform, and the meeting was very interesting and worthwhile.

In addition, two Section meetings were attended — one the Washington Section and the other the new Mid-Atlantic Section, which held its first annual meeting in Harrisburg on November 8.

Letter from Germany

A recent letter from Neal McCandliss (Member, ITE) tells of a new job with the Southern Area Command at Munich.

Apparently recovered fully from some heart trouble, McCandliss and family spent an interesting summer in Switzerland and Italy, and had orders to report to Bremerhaven for transportation home when the new job offer came along and they decided to stay.

"Fritz Hemingway" McCandliss on vacation.

W. A. Bugge, Washington Director of Highways, accepts the ITE plaque from F. B. Crandall, representing the Institute.

Governor Elmo Smith of Oregon (center) hands the ITE plaque to W. C. (Dutch) Williams, State Highway Engineer. H. C. Higgins, who made the presentation for the Institute, is at the left.

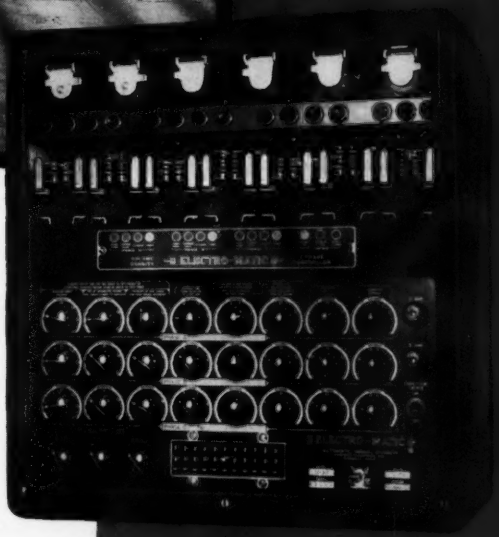
Illinois Alumni Meet

A special meeting of University of Illinois alumni who are ITE members was held in San Francisco during the Annual Meeting. Twelve men attended a breakfast meeting: Al Forde, Bob Allen, Charlie Rex, Dan Hanson, Bill Marston, Jack Henberger, Evan Olmstead, Teke Wiley, Bob Zralek, Jim Musik, Harry Harrison and John Baerwald. The last two were present as honorary and probationary members respectively. Your Executive Secretary was unable to attend, there being a special meeting of the Board of Direction scheduled at the same hour. Two other Illini at the Annual Meeting didn't get up in time. At least 31 Illinois men are in ITE and they plan to meet at least once a year.

Fire Prevention and Traffic

Two bulletins of the National Board of Fire Underwriters have recently

55,000 Vehicles per day



Baltimore's busy Park Circle handles 55,000 vehicles in an average day on six converging approaches. The problem is intensified because of heavy reversals of directional flow and fast developing peaks. Add the seasonal traffic to and from Maryland's famed Pimlico Race Track, the burden of feeder routes to rapidly growing residential sections, and you have the elements of a real problem intersection.

Write for Bulletin C-115-B

It takes a 1033 to handle the really tough ones!

TRAFFIC ACTUATED

AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INCORPORATED

NORWALK, CONNECTICUT

come to headquarters. One, No. 267, deals with fire hazards in open air parking garages. It will be of interest to any traffic engineer responsible for such structures.

The other bulletin, No. 273, is entitled "Important Considerations in Correcting Urban Traffic Conditions." It deals with the problems of the fire department in congested city traffic, and provides the traffic engineer with some additional arguments for restricting parking, etc.

Both bulletins may be obtained from the National Board of Fire Underwriters, 85 John St., N. Y. 38, N. Y.

Coming Events

January 7-11—HIGHWAY RESEARCH BOARD—
Annual Meeting, Sheraton-Park Hotel, Washington, D. C. Contact: HRB, 2101 Constitution Ave., Washington 25, D. C.

January 21-25 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—
Winter General Meeting, Hotel Statler, New York, N. Y. Contact: AIEE, 33 W. 39th St., N. Y. 18, N. Y.

January 28-February 2 — AMERICAN ROAD BUILDERS ASSOCIATION—
Annual Convention and Road Show, Chicago Amphitheatre, Chicago, Ill. Contact: ARBA, World Center Bldg., Washington 6, D. C.

February 18-22—AMERICAN SOCIETY OF CIVIL ENGINEERS—
Convention, Hotel Heidelberg, Jackson, Miss. Contact: ASCE, 33 W. 39th St., New York 18, N. Y.

March 3-5—SOUTHERN SAFETY CONFERENCE & EXPOSITION—
John Marshall Hotel, Richmond, Va. Contact: W. L. Groth, Exec. Dir., Box 8927, Richmond 25, Va.

March 3-9—AMERICAN SOCIETY OF PHOTOGRAMMETRY & AMERICAN CONGRESS ON SURVEYING & MAPPING —
Shoreham Hotel, Washington, D. C. Contact: ASP-ASCM, 1515 Massachusetts Ave. N.W., Washington 5, D. C.

March 17-21—AMERICAN SOCIETY OF PLANNING OFFICIALS—
Annual Planning Conference, Sheraton-Palace Hotel, San Francisco, Calif. Contact: ASPO, 1313 E. 60th St., Chicago 37, Illinois.

September 9-13—ILLUMINATING ENGINEERING SOCIETY —
National Technical Conference, Biltmore Hotel, Atlanta, Ga. Contact: IES, 1860 Broadway, N. Y. 23, N. Y.

September 23-27 — INSTITUTE OF TRAFFIC ENGINEERS—
Annual Meeting, Statler Hotel, Detroit, Mich. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

Virginia's plaque is presented by Past President Prisk to J. P. Mills, Jr., Traffic and Planning Engineer, Virginia Department of Highways.

R. Harrison Young, Rochester (N.Y.) Traffic Engineer, shakes hands with E. G. Wetzel, ITE Secretary-Treasurer, as Jacob Gitelman, President of the Rochester Safety Council, looks on.

October 13-15 — AMERICAN INSTITUTE OF PLANNERS —
Annual Meeting, Congress Hotel, Chicago, Illinois.

October 21-25—NATIONAL SAFETY COUNCIL—
Annual Safety Congress & Exposition, Congress, Conrad Hilton and other Hotels, Chicago, Ill. Contact: NSC, 425 N. Michigan Ave., Chicago 11, Illinois.

REFLECTORIZED CUTOUT LETTERS IN SIZES FROM 4" TO 30"

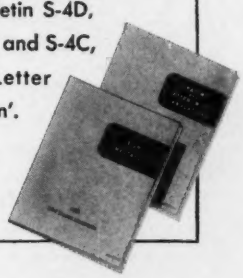
for simplified sign construction

Latest additions to the complete alphabets of STIMSONITE letters now give you letter height selections ranging from 4" to 30" (in capital letters), and a wide variety of upper and lower case alphabets. These weatherproof individual letters are embossed, durably finished and preassembled with brilliant STIMSONITE reflectors for superb legibility, day and night.

Individual, detachable letters, digits, border strips and symbols make it an easy job to lay out signs on the spot, to fill a wide range of requirements without costly production equipment. Field repairs and maintenance are practically nil. And, individual letters are easily removed and reused for temporary signing.

2 FREE INFORMATIVE NEW BULLETINS

For detailed information on STIMSONITE cutout letters and their use, ask for bulletin S-4D, 'Sign Messages', and S-4C, 'Spacing and Letter Width Tabulation'. Address Dept. S1-61.



STIMSONITE *for* — *Seeability* / *Readability* / *Durability*

AGA DIVISION

ELASTIC STOP NUT CORPORATION OF AMERICA
1027 NEWARK AVENUE, ELIZABETH 3, NEW JERSEY

Yearbook Changes

BELL, Frederick L. (Associate)
Consulting Engineer, Frederick L. Bell & Associates, Inc., 110 Petroleum Building, Tallahasse, Florida

BOX, Paul Cranston (Junior)
Street Lighting Engineer, Kansas City Traffic Department. SEND MAIL: 171 Leete Street, West Haven 16, Connecticut. (Yale Student)

BRANDES, William C. (Member)
County Traffic Engineer, Dallas, Texas. SEND MAIL: 2701 North Britain Street, Irving, Texas.

CLEVELAND, Donald E. (Associate)
Research Associate, Yale Bureau of Highway Traffic, 311 Strathcona Hall, New Haven, Connecticut.

COX, Robert L. (Junior)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

ECKER, John B. (Member)
7015 Beechwood Drive, Chevy Chase 15, Maryland

FLYE, William D. (Junior)
City Hall, Riverside, California.

GIBSON, Arthur C. (Associate)
Sign Shop Supervisor, Department of Street & Traffic, 1601 Modern Avenue, Detroit 3, Michigan.

GROSS, Ralph F. (Member)
Transit & Traffic Engineer. SEND MAIL: 1118 North Harding Avenue, Chicago 51, Illinois.

HOLMES, Robert S. (Member)
Highway Construction Representative, Market Development Division, U. S. Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

HOOPER, Curtis J. (Member)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

HOOVER, Keneth M. (Associate)
Director, Mass Transportation Planning, National Capitol Planning Commission. SEND MAIL: 1711 Massachusetts Avenue NW, Washington, D. C.

KRUEPER, Lt. (jg) Harry J., Jr. (Junior)
Construction Equipment Engineer, Civil Engineers Corps, USN, MCB Three, c/o FPO, San Francisco, California.

LEVINSON, Herbert S. (Associate)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

MARLOW, Joseph S. (Junior)
Highway Traffic Engineer, Michigan State Highway Department, Planning & Traffic Division, Stevens T. Mason Building, Lansing, Michigan.

MERRIAM, Lucius A. (Member)
315 East 9th Street, Rome, Georgia.

PRATT, Charles O. (Junior)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

RICH, Marshall M. (Associate)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

ROSENFIELD, David (Junior)
Engineer, Traffic Department, Clarkeson Engineering Company, Inc., Boston, Massachusetts. SEND MAIL: 26 St. Paul Street, Apt. 3, Brookline 46, Massachusetts.

SMITH, Wilbur S. (Member)
Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

STRONG, Charles P. (Junior)
Assistant Highway Engineer, California Division of Highways, San Diego, California. SEND MAIL:: 215 Cosey Beach Avenue, East Haven, Connecticut. (Yale Student)

THOMAS, Richard C. (Junior)
Senior Assistant Civil Engineer, Division of Traffic Engineering & Parking, Cleveland, Ohio. SEND MAIL: 129 West Summit Street, Chagrin Falls, Ohio.

TILLMAN, Donald C. (Junior)
Assistant District Engineer, Bureau of Engineering, Los Angeles, California. SEND MAIL: 14333 Greenleaf Street, Sherman Oaks, California.

WALBERT, Thomas P. (Member)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

WICKSTROM, George V. (Junior)
Assistant Civil Engineer, Department of Traffic, New York, New York. SEND MAIL: 844 54th Street, Brooklyn 20, N. Y.

WILCOX, Richard W. (Associate)
Southeast District Manager, Automatic Signal Division. SEND MAIL: Route No. 1, Woodstock, Georgia.

WYNN, F. Houston (Member)
Associate Traffic Engineer, Wilbur Smith & Associates, 495 Orange Street, New Haven, Connecticut.

Membership Applications

The following applications have been received since the list of applicants published in the November issue.

APPLICATIONS FOR TRANSFER

DONDANVILLE, Laurence Arthur
Traffic Engineer
De Leuw, Cather & Company
150 North Wacker Drive
Chicago 6, Illinois
October 10, 1956 for ASSOCIATE grade

FISCH, Arnold G.
Traffic & Safety Engineer
New York State Thruway Authority
P. O. Box 189
Albany, N. Y.
October 29, 1956 for MEMBER grade

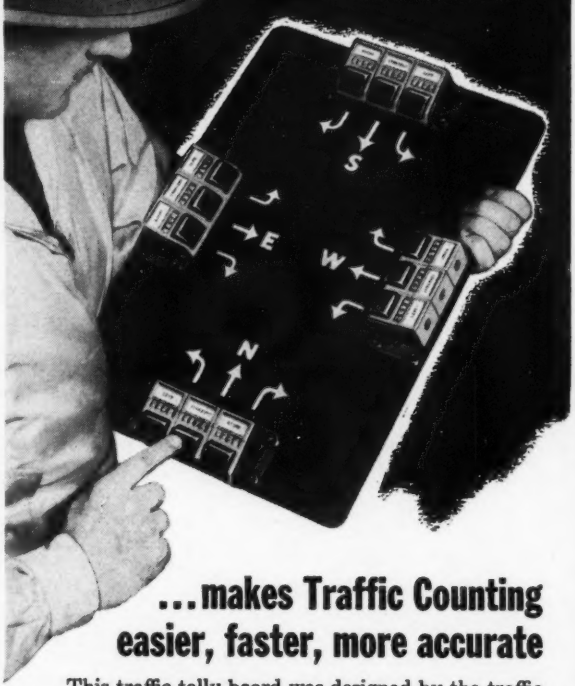
JOHNSON, Paul Robert
Senior Civil Engineer
Engineering Division
City Hall
Pueblo, Colorado
October 15, 1956 for ASSOCIATE grade

VEEDER-ROOT

VARY-TALLY

Multiple-Unit Reset Counter

* Veeder-Root does not make or supply this or any other type of mounting board for the Vary-Tally Counter.



...makes Traffic Counting easier, faster, more accurate

This traffic tally board was designed by the traffic engineers of a large eastern city, and produced by them for their own use.* 3 Vary-Tallies on each side of the board count and classify all traffic entering intersections from any direction. Positive action of the large finger-keys makes it easy for operator to keep up with heaviest traffic flow.

Veeder-Root makes the Vary-Tally in any combination up to 6 banks high and 12 units wide . . . also in single units. All counters in one bank are reset by one turn of one knob. See how Vary-Tallies can help in *your* traffic-control problems. *Write.*

VEEDER-ROOT also makes Hand Tallies (single) and counters for Parking Meters, Metering Devices, Wheeled Measuring Devices.

'The Name that Counts'

VEEDER-ROOT INC.

HARTFORD 2, CONNECTICUT

TEL. JACKSON 7-7201

September 7, 1956

Formal presentation of the Certificate of Achievement, awarded to the City of Indianapolis, Indiana. Left to right: W. Dan Kibler—Chairman, Mayor's Traffic Improvement Committee; Phillip L. Bayt—Mayor; Matthew C. Sielski—Vice President, Institute of Traffic Engineers and Stanley T. Siegel—City Traffic Engineer.

Section News

INDIANA SECTION

From report of Secretary James H. Cox:

Summer Quarterly Meeting — Meeting was held in Indianapolis on July 13. Correspondence from *Paul Rice* concerning the work of the committee of the ITE on the Warrants For and Experiences With Yield Signs was brought to the attention of the Section and following a discussion on Yield Signs, a resolution was to be drafted to indicate the Indiana Section was in favor of the necessary legislation to legalize the use of these signs in Indiana. Possible revisions to the present statute regarding the establishment of traffic engineering departments in Indiana cities was discussed and a legislative committee was appointed to investigate the possibilities of getting these revisions passed in the legislature which meets in January, 1957.

NEW APPLICATIONS

BOGGS, Henry Patterson
Planning Engineer I
State Road Department
DeLand, Florida
October 10, 1956 for MEMBER grade

BURAS, Thomas Franklin, Jr.
Civil Engineer II
Department of Street Transportation
City Hall, Room 607
18th & Farnam Streets
Omaha, Nebraska
October 15, 1956 for JUNIOR grade

CONNER, Melvin A.
Engineer of Traffic & Planning
Florida State Road Department
Holland Building
Tallahassee, Florida
November 1, 1956 for MEMBER grade

DEMSHAR, Vencil Franklin
District Traffic Engineer
Wisconsin State Highway Commission
310 South West Avenue
Waukesha, Wisconsin
November 6, 1956 for JUNIOR grade

JACKS, Marshall, Jr.
Assistant Traffic Engineer
Department of Streets & Traffic
735 Randolph Street
Detroit 26, Michigan
October 25, 1956 for JUNIOR grade

JONES, Floyd Irvin
Assistant Traffic Control Engineer
Traffic Department
Kansas Highway Commission
Masonic Temple
Topeka, Kansas
October 31, 1956 for JUNIOR member

KLINE, Floyd A., Jr.
Assistant Traffic Engineer
Indiana State Highway Department
Box 150
Greenfield, Indiana
November 9, 1956 for JUNIOR grade

MARKS, Leslie M.
Planning & Programming Engineer
U. S. Bureau of Public Roads
Pennsylvania District
105 North Front Street
Harrisburg, Pennsylvania
November 5, 1956 for ASSOCIATE grade

PETERSEN, Marshall Edward
Civil Engineer II
Illinois Division of Highways
160 North LaSalle Street
Chicago, Illinois
October 17, 1956 for ASSOCIATE grade

WOOSTER, David Elmer
Assistant Traffic Engineer
Hall of Records
200 Orange Street
New Haven, Connecticut
October 12, 1956 for JUNIOR grade

STOP
STOP ACCIDENTS!
INCREASE SAFETY!
Yes, you can buy SAFETY ON THE ROAD with the right signs and equipment—built for lasting service.
New RED STOP SIGNS
Provide quick identification — day or night. Approved Joint Committee on Uniform Traffic Devices. 16 gauge zinc coated steel or .081" aluminum. 24" x 24" size.
GIANT HIGHWAY CONSTRUCTION SIGNS
These 6' x 8' and 3' x 4' signs are easily seen hundreds of yards away from construction areas . . . allow motorists ample warning and provide extra safety for your men. Reflectorized, steel with wood framing, weather-proofed, and road tested. Write for quotation on special signs.
DANGER
USE CAUTION
CONSTRUCTION
AT INTERSECTION
NEW YORK STATE DEPT OF PUBLIC WORKS
CAUTION
MEN WORKING
E-Z BARRICADE
All-steel. Sets up easily and quickly wherever hazard conditions exist. Portable, highly visible. Variety warning signs. 4', 6' and 8' lengths. 34" high.
R R
ONE WAY
NO PARKING HERE CORNER
20 MPH
SLOW
SPEED LIMIT 30 MPH
HIGHWAY AND TRAFFIC SIGNS—
Hundreds of standard and special legends.
Write for complete legend listings and prices TODAY. You'll like dealing with one source of supply for all your safety needs.
EASTERN METAL
of Elmira, Inc. 140 Harrison Street
Elmira Heights, N. Y.

Fall Quarterly Meeting — The Fall Quarterly Meeting was held in Indianapolis on October 5. The nominating committee reported its slate for the 1957 officers. The section will vote by mailed ballots, and the ballots will be opened and counted at the next meeting. The legislative committee asked for additional information regarding the revisions to the present statute regarding the establishment of the traffic engineering departments in Indiana cities and will make a full report at the next meeting. The Section instructed the Secretary-Treasurer to convey their appreciation to Mr. L. R. Jackson, President of Firestone Tire and Rubber Company, for his salute to the ITE on his radio and TV program, "Voice of Firestone." It was reported to the Section that the ITE Technical Council is requesting the various sections to assume certain projects. Several projects were discussed, and the final decision was to be made at the next meeting. Our next meeting was set for Monday evening, December 10.

METROPOLITAN (N.Y.) SECTION

From October Newsletter, E. A. Boulding, Chairman, Newsletter Committee.

September 6th Meeting Notes

Thirty-one members and guests were present at the dinner meeting at the National Arts Club and were called to order by *President Quinby*. Many items of business were presented prior to the message given by the guest speaker, Mr. C. E. Swain, Division Engineer of the Bureau of Public Roads.

Vice-President Leonard described the tentative programs for future meetings while *President Quinby* indicated that this month the Section would reaffirm its intention of submitting a formal invitation to the National Board of Direction of the ITE next year to hold the Annual Meeting of 1959 in New York City.

Mr. Ricker explained that the National Technical Council was considering an idea of turning over specific technical committee assignments to the various local sections for review and for drafting proposed policies on timely subjects.

Through the urgings of *Mr. Murphy* the Section agreed to request the National Technical Council to indicate its position on the use of the STOP sign especially as a speed control device.

Motions were made and carried by the membership to inquire of the Greater New York Safety Council, Inc. whether the Section could sponsor and arrange a session on Traffic Engineering at the Council's 27th Annual Convention and Exposition and to send a letter to the New England Section advising it that our Section would support their candidate for Director from District 1 in event *Mr. Wetzel* was elected National Secretary-Treasurer.

Mr. C. E. Swain spoke on the subject: "The Implications of the Highway Bill to the New York Metropolitan Area." This able speaker outlined the salient features of the highway bill which is the backbone of the Federal Interstate System and which provides for payment of 90% of construction costs by the Federal Government for that System. The history of federal aid for highways was traced through the years.

The 1956 Act, which stresses the control of access for the System, emphasizes the use of the AASHO Design Criteria. A brief description was given of the Interstate System in this metropolitan area, although no definite location of any particular project was ascertained. The need of a local highway system to complement the Interstate System was explained.

A lively question and answer period followed *Mr. Swain's* formal presentation.

METROPOLITAN MEMBER NEWS

Mr. Benedict G. Barkan

Benedict G. Barkan, former Asst. City Planner with the City of Syracuse, has moved to the Yale Bureau of Highway Traffic as a Research Associate. We know all the Section Members wish him well at his new job.

Mr. John Pendleton

John Pendleton, former Asst. Civil Engineer in the Bureau of Traffic and Safety for the New York Thruway, has been promoted to Senior Civil Engineer and is now Asst. Superintendent of Maintenance in Charge of Highways. The Bureau of Traffic and Safety has lost a good man. Congratulations to John on his new advancement.

Mr. Thomas M. Cleary

Thomas M. Cleary, Asst. Civil Engineer in the N. Y. State Bureau of Traffic and Safety, has been transferred from the Syracuse Division office to the main office in Albany. We hope now that Tom will be able to attend our Section meetings.

SOUTHERN SECTION

From October Newsletter, John T. Hanna, Secretary-Treasurer, Southern Section.

Donald W. Barry, P. E., Traffic and Planning Engineer, Orlando, Fla. writes: "Things are shaping up pretty well here in Orlando, both domestically and businesswise. It seems that the administration is very progressive in their approach to this traffic problem. Of course, time will tell."

We are advised that *Don* is installing a Cycle Selector System in Orlando. Eleven intersections are going in now and later 16 more will complete the system.

Mr. James S. Burch, Raleigh, North Carolina with North Carolina State Highway Commission has just returned from a week at sea on USS Des Moines (heavy cruiser) out of Norfolk, Virginia with 100 explorer Boy Scouts, as Cruise Director.

He reports: "No port of call, fired guns, ships drills, inspections. Fine trip by all."

The Charlotte (N.C.) Observer, Sunday, September 9, 1956 issue contained the following article:

"When City Council first talked about the cool-of-the-evening downtown parking ban, the S & W's Frank Sherrill had a few words to say against it. Furthermore, he talked about the Fort Worth (Texas, of course) plan. I'm not too familiar with it, but I understand they have the answer,' said Sherrill. He wished, he added, that Council would look into it. This is what a look into it disclosed: *The Fort Worth Plan* is called the Gruen Plan. Among other things, it would stop ALL downtown traffic in Fort Worth. Nothing but pedestrians during daylight business hours. Sole exception would be a system of electric tram cars to shuttle downtowners from parking areas to working and shopping areas. They would park at the edge of the downtown section. The plan is scheduled to go into effect in 1970 in Fort Worth. Charlotte Traffic Engineer *Herman Hoose* says the Fort Worth Plan would be fine with him. It would mean no downtown parking, instead of a part-time ban."

On Sunday, September 16, 1956, the same newspaper reported:

"Traffic Engineer *Herman Hoose,* the man of a 'Thousand islands' and an equal number of headaches, reaped a richly deserved national award last week.

"Merchants to the contrary, it would be a blow if the City lost him. And that is a possibility unless some adjustments are made."

Here are several of the reasons Herman won these awards:

"The U. S. 29 By-Pass at the City Limits of Charlotte is under construction and this will be four lanes divided, limited access highway.

"On September 14, 1956 the City of Charlotte put into use its first radar detectors for actuated equipment. This is located at two intersections using a three-phase fully actuated volume density controller, and the other intersection using a three-phase controller. This is the first installation of traffic control by radar in the State of North Carolina."

Karl Bevins, City Traffic Engineer of Atlanta, Georgia has been using square signal heads for lane directional signals where reversible or unbalanced lanes exist.

From St. Petersburg, Florida, *Walter E. Ducker,* Traffic Engineer reports:

"We are making 12 installations of oversize signals, all on 34th Street (U.S. 19). The signals will be coordinated for progressive movement at speeds of from 24 mph to 40 mph depending on the time of day. Coordination will *not* be completed under this year's budget. We hope to accomplish this next year.

Next year it is expected that the school signs will face traffic *only* when children are en route to and from school.

The truck route ordinance is before Council now. Special signs will aid our many tourists in finding state and federal routes.

A report on a parking survey made in April by Ramp Buildings is due soon."

Welcome to our new member—*Mr. Basil Andrews*—the new traffic engineer for the city of Savannah, Georgia. He was assigned this new position on September 18th by the Savannah Metropolitan Planning Commission and also the traffic consultant to the commission.

Congratulations are in order to *George Kunde* for his excellent job in getting the ITE meeting in Miami, Florida for 1958. We know that it took a lot of hard work but we know it will be well worth it. All members of this jurisdiction will have to pitch in and make this the biggest and best ITE meeting ever.

YALE STUDENT CHAPTER

The 1956-57 class at the Yale Bureau of Highway Traffic has formed a Student Chapter. Officers for the year are: Capt. James E. Coleman, president; T. J. Morawski, vice president; John J. DeShazo, Jr., secretary; and Benjamin M. Givens, Jr., treasurer.

The full roster of the Chapter, together with home addresses, is shown below:

Abend, Norman A., Alexandria, Virginia.

Bailey, Robert, Sidewalk Engineer, City of Calgary, Alberta, Canada.

Bass, Donald E., Cheyenne, Wyoming.

Box, Paul Cranston, Street Lighting Engineer, Traffic Department, Kansas City, Missouri.

Burks, James W., Jr., Associate Resident Engineer, Texas Highway Dept., McKinney, Texas.

Cantilli, Edmund J., Civil Engineer I, Port of New York Authority, New York, New York.

Carlsson, Bernard, Assistant Engineer, City Engineer's Department, Johannesburg, South Africa.

Ceballos, Guillermo G., Auxiliary Engineer, Ministry of Obras Publicas Negociado de Urbanismo, Habana, Cuba.

Coleman, Capt. James E., G-3 Section, Hq. TTC, Fort Eustis, Virginia.

Cottam, Roy W., Acting Director of Traffic Signals, New York City Dept. of Traffic, New York, New York.

Cunningham, Stuart A., Traffic and Planning Division, State Highway Dept., Dover, Delaware.

Czyz, Iwan, Graduate Civil Engineer, Bureau of Traffic Engineering, Philadelphia, Pa.

Delaney, Desmond J., Assistant Engineer, Country Roads Board, Victoria, Australia.

DeShazo, John J., Jr., Texas Highway Department, Designing Engineer, Amarillo, Texas.

Ferro, William N., Hwy. Planning Engineer, Virginia Department of Highways, Richmond, Virginia.

Fiske, John R., Assistant to the Registrar, Motor Vehicle Branch, Halifax, Nova Scotia.

Freeman, Robert L., Toledo 13, Ohio.

Galioto, Anthony J., Planning Technician, Port of New York Authority, New York, New York.

Givens, Benjamin M. Jr., District Bridge Engineer, Pennsylvania Turnpike Commission, Avoca, Penna.

Goldberg, Serge, Service Central d'Etudes Techniques due Ministere des Travaux Publics, Paris, France.

Grabow, Milton, Junior Highway Engineer, State Highway Department, Hartford, Connecticut.

Grigg, John L., District Engineer, Civil Branch, Engineering Dept. Melbourne & Metropolitan Tramways Board, Melbourne, Victoria, Australia.

Harding, Nelson S., Omaha, Nebraska.

Halpern-Herla, Marc, Ingenierer des Ponts et Chausses, Bd Saint Medard Mont De Marsan (Landes) France.

Kingman, William O., District Traffic Engineer, Dept. of Highways, Wenatchee, Washington.

Kolom, Lester L., Electrical Engineer, Traffic Division, Bureau of Electricity, City of Chicago, Chicago, Illinois.

Kudlick, Walter, Highway and Traffic Engineer, Edwards, Kelcey and Beck, Consulting Engineers, Newark, N. J.

Lessieu, Eugene J., Planning Technician, Port of New York Authority, New York, New York.

Little, James H., Bridge Designer, State Highway Dept., Little Rock, Arkansas.

Morawski, Teddy J., Programming and Planning Engineer, U. S. Bu reau of Public Roads, Concord, New Hampshire.

Oliphant, David N., Civil Engineer, City Engineer's Dept., Salisbury, S. Rhodesia, Africa.

Peterson, Stephen G., Engineer, John Clarkeson Consulting Engineers, Watertown, New York.

Piteo, Nicholas H., Assistant City Engineer, Great Bend, Kansas.

Pulliam, Kenneth P., So. Charleston 3, W. Virginia.

Richter, Jacques, Andrews, Clark and Buckley, Cons. Engineers, New York, New York.

Rothenberg, Morris J., Ogdensburg, New York.

Schempers, William Jr., Needham, Mass.

Strong, Charles P., Assistant Highway Engineer, Division of Highways, San Diego 10, California.

Taylor, Grady J., Jr., Highway Engineer, Howard, Needles, Tammen and Bergendoff, Consulting Engineers, Topeka, Kas.

Thompson, James A., Traffic Control Engineer, State Highway Dept., Macon, Mo.

Tombre, Egil, Assistant Engineer, Oslo byplankontor, Oslo, Norway.

Van Niekerk, Cornelius, Senior Engineer, City Engineer's Department, Pretoria, South Africa.

(Continued on page 145)

THE YALE STUDENT CHAPTER

Top — Givens, Coleman.
Sixth Row — Czyz, Petersen, Little, Carlsson, Grabow, Thompson, Taylor.
Fifth Row — Schempers, Strong, Cunningham, DeShazo, Fiske, Tombre, Goldberg, Grigg.
Fourth Row — Freeman, Rothenberg, Oliphant, Galioto, Cottam, Ceballos, Donahue, Kingman.
Third Row — Van Nickerk, Kudlick, Burks, Dox, Morawski, Lessieu, Harding.
Second Row — Pulliam, Piteo, Richter, Abend, Bailey, Herla.
First Row — Cantilli, Kolom, Ferro, Bass, Delaney.

New Appointments

White Named Fort Wayne Traffic Engineer

James T. White (Mem., ITE) has been named Traffic Engineer for Fort Wayne, Indiana. This is White's second tour of duty as Traffic Engineer for Fort Wayne, having served in this capacity earlier from 1939 to 1948.

In 1949, White became the first Traffic Engineer in Evansville, Indiana. In 1952 he became Design Engineer, assigned to the Metropolitan Area Traffic Survey Unit of the Indiana State Highway Department.

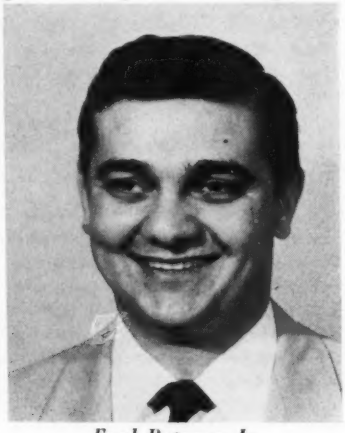
James T. White

White has been active in the Indiana Society of Professional Engineers, having held several offices. He, together with Ernest Miller and Herman Hoose, formed the Indiana Traffic Engineers Association, and he served as its president during 1947-48. In 1951 this association voted to form the Indiana Section of ITE. White was elected president of the Section for 1954-55.

Potenza to National Safety Council

Fred Potenza, Jr. (Jun. Mem., ITE) has joined the staff of the National Safety Council in Chicago. He is currently assigned to the Inventory Division, where he is assisting Harry Porter.

Potenza came to the Council from the Chicago Motor Club, where he had worked as a traffic engineer under Matt Sielski. At the Motor Club, he worked with officials and citizen groups, carrying on surveys and making school crossing protection studies.



Fred Potenza, Jr.

Prior to his work with the Motor Club, Potenza had been with the Traffic Engineering Department of the Chicago Transit Authority.

A former electrical engineering student at Northwestern University, Potenza spent two years in Germany with the 4th Armored Division. He has been active in the Midwest Section, serving on the Publications Committee and as chairman of the Special Events Committee of the Section.

Evans Named Western Manager for Wilbur Smith

Henry K. Evans (Mem., ITE) has been named manager of the Western Division of Wilbur Smith and Associates, consulting engineers with headquarters in New Haven.

Prior to his present engagement, Evans had been active in a number of traffic and transportation areas. He was Special Assistant to the Vice President, Operations, Pacific Intermountain Express Company. For six years before that, he was Highway Transportation Specialist for the Chamber of Commerce of the U. S. Earlier, he worked for the Automobile Club of Southern California, the National Safety Council, National Conservation Bureau (now Association of Casualty and Surety Companies) and DeLeuw, Cather & Company.

Henry K. Evans

Evans is well known to the Institute because he served as editor of the Traffic Engineering Handbook at the time of its 1950 revision, in addition to earlier service as editor of the magazine. He has written extensively for magazines and technical journals and has contributed papers to many national meetings.

In his capacity as manager of the Western Division for Wilbur Smith and Associates, Evans will be supervising work in all the western states. The office of the Western Division is located at 417 Market Street, San Francisco 5, California.

Enfield Named As New Solicitor for BPR

Secretary of Commerce Sinclair Weeks has announced that he will appoint Clifton W. Enfield of Salem, Oregon as Solicitor, Bureau of Public Roads. Mr. Enfield is Assistant Attorney General of the State of Oregon and Chief Counsel of the Oregon State Highway Commission. He will complete his state commitments in the near future and then will come to Washington to be sworn in as Solicitor. Secretary Weeks pointed out that Mr. Enfield has had wide state highway experience in supervising land acquisition for highways and park purposes, together with long practice in right-of-way procedures, claims, contracts, equity suits, legislation and other highway matters. He is Secretary of the Legal Affairs Committee, American Association of State Highway Officials, and holds posts in other important highway and legal organizations.

Strictly Business

Frieling Goes Overseas For Ebasco Services

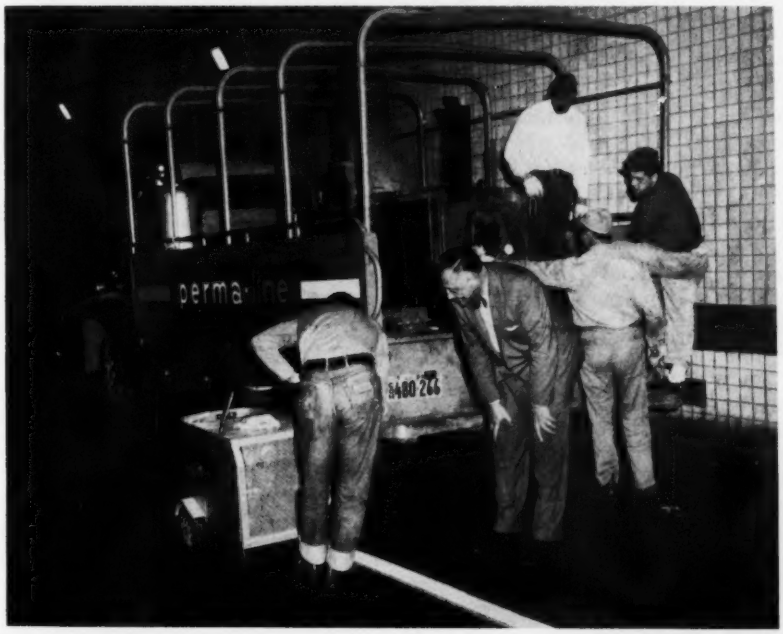
G. H. Frieling (Mem., ITE) has joined the staff of Ebasco Services of New York as consulting engineer. He left this country late in September for Sidney, Australia, where he will be stationed for the next eight months in

G. H. Frieling

connection with a study of transportation in the state of New South Wales. He can be reached in Sidney c/o the Minister for Transport, 53 Martin Place, Sidney, N.S.W.

Frieling was with the Kansas City Public Service Company prior to joining the Ebasco staff. Starting with this company immediately after graduation from the University of Michigan in 1926, he organized the Research Department in 1942 and in 1947 was elected vice president in charge of transportation.

In addition to his membership in the Institute, Frieling is a member of the American Society of Civil Engineers and the American Society of Planning Officials. He is a registered professional engineer in Missouri.



New Plastic Lines Installed in Holland Tunnel

Those white, lane-dividing traffic lines in New York's Holland Tunnel these days should be whiter and longer-lasting than ever before, according to the manufacturer of a new thermo-compound.

The port of New York Authority recently contracted for 34,000 feet of the new preparation which was installed in mid-October. Working from 11 P. M. till 5 A.M. the job was completed in four nights. Traffic was shut off alternately in the two tubes while the work was in progress.

Two four-inch lines, separated by a space of four inches, were laid down in each tube at a temperature of 400 degrees farenheit.

The 34,000 feet used represented one of the largest quantities of the new compound ever used on one job and the first in a traffic tube such as the Holland Tunnel.

The installation was made under the direction of Dwight T. Myers, former deputy commissioner and chief engineer of the New York City Department of Traffic, who is now president of the Veon Chemical Corp. of Long Island City, manufacturers of the new product.

The compound, known as Perma-Line, is expected to last 4 to 6 times as long as previously used materials for the marking of traffic lanes.

SECTION NEWS

(Continued from page 143)

ILLINOIS STUDENT CHAPTER

The University of Illinois Student Chapter for 1956-57 has been organized with 16 members. Officers for the year are: Dale W. Ballinger, president; Harold W. Hill, vice president; and Neil S. Kenig, secretary-treasurer.

A full roster of the chapter follows:

Ballinger, Dale W., 106 N. Vine St., Urbana, Illinois.

Bell, Hans F., 505 W. Park Ave., Urbana, Illinois.

Brozio, Robert S., C-44 Stadium Terrace, Champaign, Illinois.

Bunte, William, 806 S. 5th St., Champaign, Illinois.

Dees, Dan, Civil Engineering Hall, R.301, Urbana, Illinois.

Greenwood, George W., 510 N. Prospect, Champaign, Illinois.

Guthrie, John T., 601 W. Washington, Urbana, Illinois.

Guyton, Joseph W., Civil Engineering Hall, R. 301, Urbana, Illinois.

Hill, Harold W., G-53-B Stadium Terrace, Champaign, Illinois.

Karmeier, Delbert, 806 S. 5th St., Champaign, Illinois.

Kasal, Rudy J., Barton House Rm. 18, Men's Residence Hall, Champaign, Ill.

Kenig, Neil S., 2747 W. Pratt Ave., Chicago, Illinois.

Luettich, Richard, 310½ E. Stoughton, Champaign, Illinois.

Smania, Richard A., 1104 W. Illinois St., Urbana, Illinois.

Stonecipher, A. Keith, Civil Engineering Hall, R. 301, Urbana, Illinois.

Thompson, George, 1320-3 Arbor PGU, Champaign, Illinois.

Wozniak, Joseph, 207 W. Griggs, Urbana, Illinois.

New Publications

Parking Guide for Cities.

Division of Research, Bureau of Public Roads (reported by R. H. Burrage, D. A. Gorman, S. T. Hitchcock and D. R. Levin). U. S. Government Printing Office, Washington 25, D.C. 1956. 172 pp. 55 cents.

In 1947 the Bureau published a pamphlet entitled *Factual Guide on Automobile Parking for the Smaller Cities*, now out of print. The current volume brings this earlier material up to date and adds new material. One chapter dealing with parking and travel habits is completely new in this volume.

Although much of the material relates to small and medium-sized cities, the principles are usually valid for large cities. Chapter headings include:

- Parking Studies
- Parking and Travel Habits in the CBD
- Action for Relief of Parking Congestion
- Administration
- Land Acquisition
- Public Financing
- Legal Aspects
- Parking Meters
- Location and Design of Parking Facilities

There are appended a list of selected references and various model and sample statutes and ordinances.

Although the reporters point out that much more research is needed and that there is need to apply results to specific cases, this volume will be of much help to citizen groups and to official agencies in their quest for assistance in solving one of our most troublesome urban problems.

What Freeways Mean to Your City

Automotive Safety Foundation, Washington, D. C. October, 1956. 47 pp.

The impact of freeways on cities, including such problems as safety, traffic service, travel time savings, effect on property values and business development, cost and design, are discussed in this well illustrated report. Based on the experience of 15 cities with freeway construction and operation, the publication is aimed at both city officials and citizens who are faced with the question of freeway development.

Traffic Controls and School Child Safety.

School Crossing Control Manual. Traffic Dept., Kansas State Highway Commission, Topeka, Kans. Sept., 1956. 32 pp. mimeo.

This manual is designed to provide some degree of standardization within the State of Kansas in the matter of signing school zones and school crossings. A total of ten standard patterns of signs and signals is provided, for rural and urban, mid-block and corner, low-volume to high-volume situations.

Reported is the Kansas record of 32 child pedestrian accidents involving children going to and from school and 502 not related to the school problem.

Parking and Its Relationships To Business

Special Report 11-D, Highway Research Board, Washington, D. C. 1956. 16pp. 60 cents.

This is a summary of the results of the project aimed at developing the relationship of parking to business. The project was begun in 1951, and several reports have been presented covering individual studies or phases of the project. (One of these is listed below.)

Important conclusions of this study are that the principal factors involving shoppers' travel habits are: (1) total travel time from home to shop, and (2) the available selection of goods. Parking must be viewed in its proper perspective, taking into account transit facilities, nature of goods available, distance from shops, cost of parking, and general merchandising practices.

Parking and Buying Habits Of A Store's Customers

Special Report 11-C, Highway Research Board, Washington, D. C. 1956. 18 pp. 60 cents.

This is one of the special reports issued in connection with the major study of parking in relation to business. It reports on the work in Lexington, Kentucky, in the study of parking habits of shoppers and the effect of parking availability on their buying habits.

Time Saving Methods In Highway Engineering—Chapter II

Traffic Engineering. Highway Research Board, Washington, D. C. June, 1956. 39 pp. mimeo. 60 cents.

This report, which is one of 14 chapters of the total series on time saving methods, summarizes answers to five questions put to state highway departments. The questions were:

(1) Have you developed any shortcuts in traffic field studies?

(2) Have you mechanized any of the statistical or computing procedures, or other analyses?

(3) Have you reduced any formulas to tables of values or standards to relieve the engineer from time-consuming detail?

(4) Have you used statistical control to advantage for sample selection or to test reliability of samples?

(5) Have you developed any other arrangements, process, procedure or device that conserved the time of the engineer?

Sixty-seven comments and memos were received in answer to the five questions, with one-third related to question No. 2. A wide variety of methods were cited in answer to this and other questions, and the report will be of interest to any traffic engineers interested in a more efficient operation.

ICE JAMS
OIL CO.
ZOOM GAS
"Check the oil, test the anti-freeze, and since the roads are icy, maybe you'd better pump the brakes!"
NATIONAL SAFETY COUNCIL

Texas Plans Short Course January 14-18

The Second Annual Short School on Traffic Engineering will be held at the A & M College of Texas January 14-18, 1957. The school is sponsored by: the Texas Transportation Institute of the A & M College of Texas, the Civil Engineering Department of the A & M College of Texas, the Texas Section of the Institute of Traffic Engineers and the League of Texas Municipalities.

The course is being offered to assist cities in the training of personnel responsible for the various traffic engineering functions. Subjects to be covered include:

Traffic Engineering Problems
Traffic Engineering Organization
Traffic Laws and Regulations
Speed Studies, Regulations and Zoning
Traffic Surveys and Studies
Traffic Planning
Parking
Traffic Signs, Signals, and Markings
Geometric Design (Streets, Intersections, Channelization, etc.)
Preparation and Presentation of Engineering Reports
Public Relations

Both rooms and meals will be available at the Memorial Student Center where this school will be held. The registration fee will be $10.00 which will cover the cost of the course notes, but it is not necessary to pay registration fee or deposits in advance.

Since the total attendance is being limited to 40, it is possible that a limit of one representative from each city will be necessary. Request for enrollment will be handled in the order they are received.

Roberts Safety Subcommittee Hearings Cancelled

Public hearings on the Congressional Special Subcommittee on Traffic Safety, headed by Representative Roberts (D., Ala.), originally scheduled to begin Monday, November 12, have been cancelled. A report of the hearings held will be prepared, however.

Highway Research Board Meeting January 8-11

The 1957 meeting of the Highway Research Board is scheduled for January 8 to 11 at the Sheraton Park Hotel in Washington. Committee meetings will be held Monday, and the ITE Board will meet the preceding Saturday and Sunday.

MOVING VEHICLE METHOD . . .
(Continued from page 129)

minutes would be required in Salem to achieve a relative standard error of 10 per cent. This period is in excess of available 300 minutes in the five-hour period, and would therefore indicate that a larger error would have to be acceptable for this type of study. For Jefferson, the sampling period of 196 minutes should have resulted in a relative standard error of only 9 percent.

Summarizing, the differences in daily vehicle miles obtained from the moving vehicle method compared to the recorder count method was 38 per cent in Salem for the entire area studied, and 29 per cent in Jefferson. For individual routes in Salem the differences ranged from 14 per cent to 100 per cent. For the different routes in Jefferson, the differences ranged from 6 per cent to 58 per cent. Vehicle miles computed from volume counts obtained by mechanical recorders for sample coverage and full coverage had a difference in Jefferson of 4 per cent.

The tests of the moving vehicle method of determining traffic volumes as conducted in Oregon have indicated that more study and investigation may be warranted before this method receives general acceptance and use. Although the errors are rather large and do not conform to the formulae developed by Cook County, the results are for a single study and may be the result of chance variations. Additional studies were not conducted at the time because of the time limitations in selecting a method to be used in the traffic counting program. Based upon the above study, Oregon has elected to use machine counts on a sampling basis for determining vehicle miles in urban areas.

TABLE III

Salem, Oregon
Capitol Street
Chemeketa - Center Streets
(Arterial)

Date (1956)		Day of Week	24 Hr. Volume	10 AM - 3 PM Volume	Expansion Factor Mon.	Tue.	Wed.	Thur.	Fri.
January	2	Mon.	6229	1959	3.18				
	3	Tue.	10390	3476		2.99			
	4	Wed.	9814	3051			3.22		
	5	Thur.	10158	3281				3.10	
	6	Fri.	10781	3227					3.34
	9	Mon.	10206	3232	3.16				
	10	Tue.	9903	3123		3.17			
	11	Wed.	9776	2879			3.40		
	12	Thur.	9571	2888				3.31	
	13	Fri.	10621	3243					3.28
	16	Mon.	10415	3225	3.23				
	17	Tue.	9582	3014		3.18			
	18	Wed.	10009	3014			3.32		
	19	Thur.	9782	2941				3.33	
	20	Fri.	10505	3076					3.42
	23	Mon.	9486	3049	3.11				
	24	Tue.	9563	2968		3.22			
	25	Wed.	9799	3055			3.21		
	26	Thur.	8837	2547				3.47	
	27	Fri.	-	-					-
	30	Mon.	9675	3129	3.09				
	31	Tue.	9285	2919		3.18			
February	1	Wed.	9532	2982			3.20		
	2	Thur.	9705	2965				3.27	
	3	Fri.	10364	3500					2.96
	6	Mon.	10222	3235	3.16				
	7	Tue.	9804	2990		3.28			
	8	Wed.	9827	2887			3.40		
	9	Thur.	9504	2758				3.45	
	10	Fri.	10548	3075					3.43
	13	Mon.	10132	3246	3.12				
Average			9800	3031			3.23		

Two Standard Deviations = ± 0.32

FIGURE 2
Lake Shore Drive Roadside Interview Station in Operation at Location B.

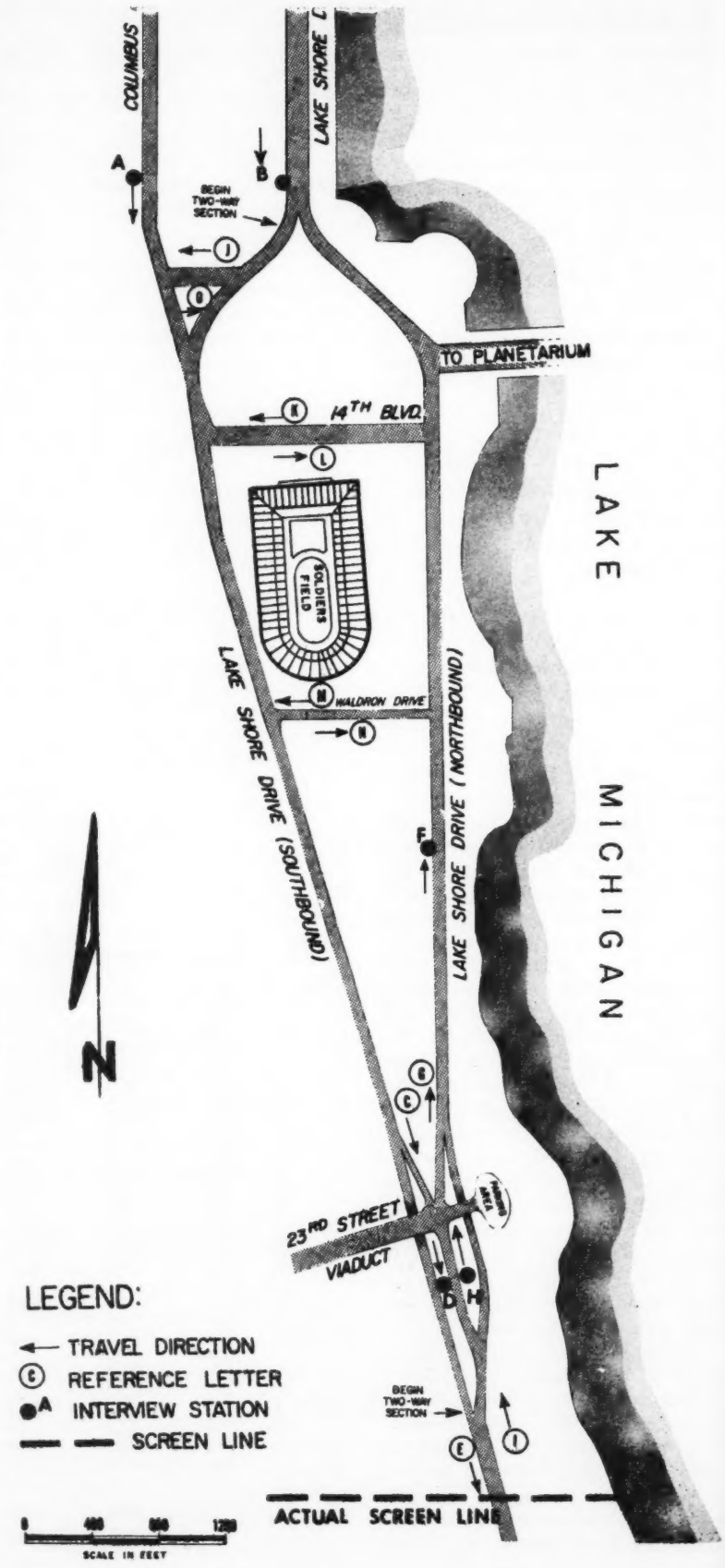
ROADSIDE INTERVIEWING . . .
(Continued from page 134)

—for example, Soldier Field or the Field Museum. These were totaled from the completed interviews and expanded in the same way as for trips destined for 23rd Street.

Traffic counts obtained at (C) by machine recorders were used to verify the off-movement as calculated. Preliminary analysis indicates good results with this method.

By the same token, it was desired not to interview vehicle drivers from 23rd Street turning north onto the Drive at (G). To avoid this, during the dayight hours of the first shift of interviewing on May 28, one man operated a battery operated megaphone at (G) advising drivers to "Please turn on your lights and you will not be stopped at the road survey ahead." Where any driver failed to cooperate—and there were very few who did—another man placed a 2-inch diameter scotch-tape-sticker on his windshield. Vehicles with lights on, or with stickers, were not stopped for interview at (F). A manual classification count was made at (G) and the total traffic entering the Drive was subtracted from the manual classification count taken at (F).

This technique was used until dusk, by which time a special lane along the left curb was established extending from (G) through the interview station at (F). This lane was marked by lanterns, red flags mounted on wooden blocks, barricades — all of the foregoing graciously provided by the Chicago Park District—and traffic cones. All vehicles from (G) were guided into this lane, and prevented from entering the main stream of traffic to be interviewed at (F). The megaphone was then used to remind drivers to "Keep in line, and you will not be stopped." This special lane arrangement was successful, and was used ex-



MAP 2 (Right)
Station Location Map.

FIGURE 3
Lake Shore Drive Roadside Interview Station with Bypass Lane in Operation at Location F.

clusively for the two remaining interview shifts—May 31, and June 4. Figure 3 shows the lane during an off-peak hour.

On the ramp, at (D) and (H), typical bypass type station layouts were used, as shown in Figure 4. At (A), (B), and (F) the basic station layouts were somewhat different, also as shown in Figure 4. The latter were an innovation suggested by the Chicago Park District Traffic Engineers. It was reasoned that if interviewing had to be suspended for any reason, these stations could be removed without crossing a moving stream of traffic and that interviewer safety would be increased by working near the curbs rather than in islands of cones in the center of the traffic stream. These stations had the further advantage of allowing some flexibility in the number of through lanes by adjusting the cone transitions inward or outward.

Chicago Park District police were posted at "P" as shown in Figure 4, and directed a selected sample of drivers into the interview lanes. At the right-side interview lanes at (A), (B), and (F), where the police officers were away from the driver's side of approaching vehicles, there was occasional difficulty in attracting the drivers' attention, but this did not prove a serious problem.

Interview lanes were quite easily kept filled. Storage space for a number of vehicles, equal to the number being interviewed ahead, were used. When one group of vehicle drivers had been interviewed and sent ahead, another group moved up at once from this space. No more than eight interviewers were ever used in a single interview lane. A series of recent studies made as part of the roadside interview survey indicates that no more than 10 interviewers can be used efficiently in a single line. The lost time of vehicles moving up into position for interview soon becomes prohibitive.

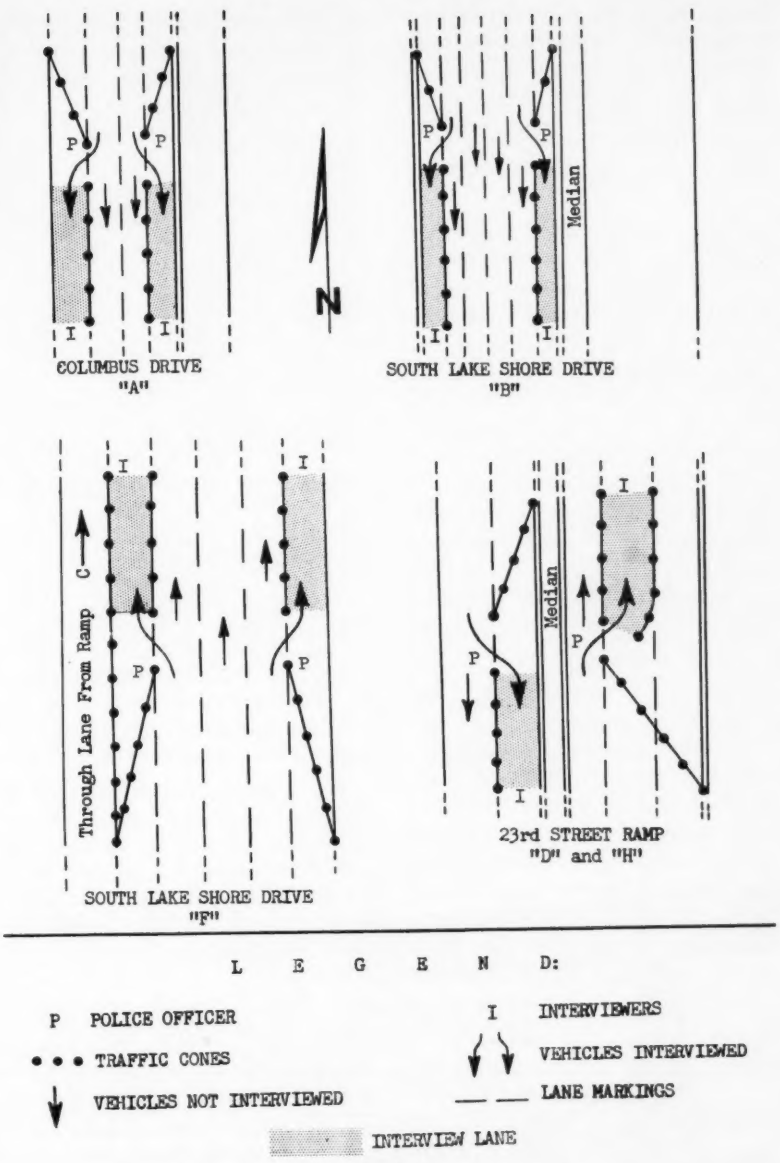


FIGURE 4
Diagrams of Lake Shore Drive Roadside Interview Station Layouts.

During the morning peak hour, on May 31, the station at (F) was altered so that interviews were taken at the right-side interview lane only. The left-side interview lane was removed entirely, and the traffic stream allowed to move freely. Vehicles from (G) continued to use the special lane set up for them. At all other times, the interview stations functioned as shown schematically in Figure 4.

Questions and Answers

In the weeks before this operation, many questions were raised. Could we

EXTEND YOUR MARKET

Europe is a large potential market for your products. We are manufacturer's agents, specializing in traffic equipment, and have good contacts with traffic authorities. We invite your inquiry.

AB Sveatrade, Postbox, Stockholm 14, Sweden
Deutsche Parkometer G.m.b.H., Georgstrasse 36, Hannover, Germany
Scanex AG, Postfacch Selnau 264, Zurich, Switzerland

hope to stop every fourth, fifth, or sixth vehicle for interview, or would we have to settle for one-in-10? Could we get our sample without a major traffic jam? Would motorist reaction be cooperative? Would we cancel in event of rain? What about night operations?

There were no injuries, and no serious accidents. There was one rear-end collision involving some damage, but it could not be attributed to the interview station ahead, but rather was the result of a driver running a red light. Drivers using the Drive during the week are usually commuters, accustomed to the heavy volumes and relatively high speeds, and this, it is believed, kept the accident potential to a minimum. Figure 5, shows the warning and advisory signs used—courtesy of the Cook County Highway Department and used throughout the survey.

The operation did, in fact, stop an average of every sixth vehicle at each of the various locations over the composite 24-hour period. Interviewing at (A), (B), and (D), southbound, provided 12 lanes of moving traffic from which to draw a sample, as opposed to only four at (E), the actual screen line. Likewise, interviewing at (F) and (H), northbound, provided nine lanes, as opposed to four at (I), the actual screen line. Table 1 shows the number of drivers interviewed at each location, according to preliminary analyses.

FIGURE 5
Variety of Signs Used in Roadside Interview Stations by the Chicago Area Transportation Study.

There were no serious delays to the moving stream of vehicles. Traffic was slowed, but seldom stopped. The few complaints from drivers themselves, and the complete absence of adverse publicity in Chicago newspapers, was tacit acknowledgment of this fact.

The night operations involved no difficulties. Extensive use of 500-watt floodlights powered by portable generators, 30-minute red railroad flares, oil pots, lanterns, and reflectorized signs, with the existing street lighting on the Drive, apparently kept motorist caution high.

Summary

About 19,000 roadside interviews from some 107,000 passing drivers were taken on Chicago's fast-moving Lake Shore Drive. While this was only one of the 86 highways on which interviews were conducted as part of the Chicago Area Transportation Study, it presented the most challenging problem, and may well be the most concentrated flow of traffic ever stopped for this purpose. There were no serious accidents and very little delay.

This experience seems to indicate that roadside interviewing can be accomplished almost anywhere, with safety, provided sound techniques are employed.

TABLE 1
Preliminary Results of Interviewing on Lake Shore Drive.

Location	7 AM-3 PM, May 31			3 PM-11 PM, May 28			11 PM-7 AM, June 12-13			Composite 24-Hours		
	Classified	Interviewed	Per Cent	Classified	Interviewed	Per Cent	Classified	Interviewed	Per Cent	Classified	Interviewed	Per Cent
A	6,148	1,126	18.3	10,405	2,008	19.3	1,832	399	21.8	18,385	3,533	19.2
B	15,837	1,902	12.0	15,828	1,724	10.9	5,287	1,051	19.9	36,952	4,677	12.7
C	2,845	0	0	3,111	0	0	1,253	0	0	7,209	0	0
D	2,304	447	19.4	4,836	564	11.7	971	232	23.9	8,111	1,243	15.3
E[a]	21,444	3,475	16.2	27,958	4,296	15.4	6,837	1,682	24.6	56,239	9,453	16.8
F	26,951	2,657	9.9	20,032	2,724	13.6	7,229	1,365	18.9	54,212	6,746	12.4
G	3,993	0	0	5,041	0	0	1,538	0	0	10,572	0	0
H	4,339	899	20.7	2,158	377	17.5	909	210	23.1	7,406	1,486	20.1
I[b]	27,297	3,556	13.0	17,149	3,101	18.1	6,650	1,575	23.7	51,096	8,232	16.1

[a] E = A + B + D - C

[b] I = F + H - G

RECOGNIZING AND . . .

(Continued from page 126)

III. Coordinate, modernize, and expand public transportation services on a metropolitan, area-wide basis making them as thoroughly attractive as practically possible. This area-wide public transportation should incorporate a coordination philosophy similar to that afforded our highway network, electric power and telephone systems.

IV. To make public transportation attractive it must be taken out of the traffic congestion glue—placed on fast separate rights of way for rapid transit and commuter trunk lines, and on exclusive city-street lanes for surface transit.

Typical of current thinking in this direction, consulting engineers have been studying the rapidly mounting transportation needs of the San Francisco Bay Area. Their recommendations, just released, call for a minimum of 123 route miles of rapid transit. Interestingly, in this connection, their proposed system layout calls for terminal to terminal speeds of 45 MPH including intermediate station stops. They are realistic as to the speed required to attract people in this day of modern automobiles, freeways and boulevards.

Highly encouraging developments are also taking place in the Chicago area. There is the heartening word that some exclusive lane provision for surface transit will soon be commenced. The Congress Street freeway project is setting world precedent through sound incorporation of exclusive lane rapid transit, and further projects of this realistic nature seem likely. Not only will the resultant speed increase materially reduce cost of providing such services but, of prime importance, major progress will be made toward giving public transportation the margin of attractiveness so necessary to win patronage.

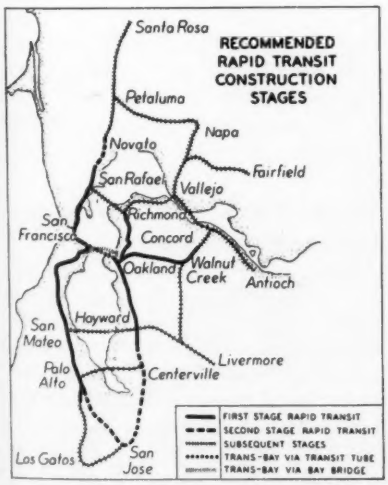


Figure 14

Proposed rapid transit network for the San Francisco Bay Area would ultimately include 390 miles of double track line.

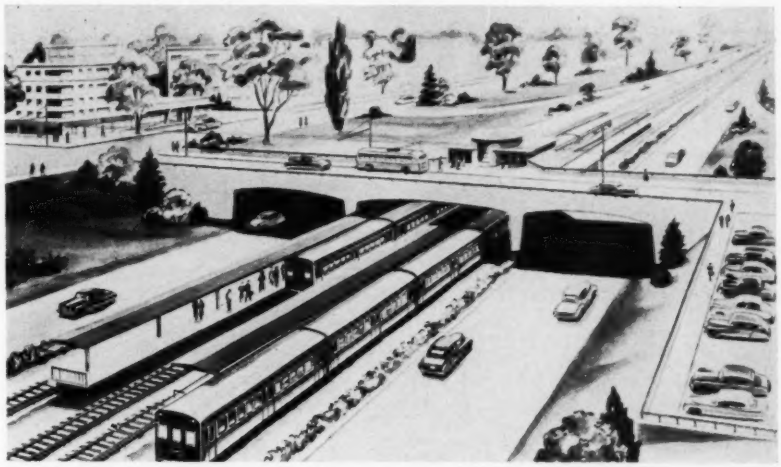


Figure 15

Chicago's Congress Street Expressway incorporates rapid transit lines in a center mall, thus securing tremendously increased capacity at negligible increase in cost.

RESPECTED! OBEYED!

SAFE-T-CONE*

All-Rubber TRAFFIC GUIDES

*U.S. Pat. Number 2,719,505

The silent workhorse of efficient traffic control!

NOW IN 3 SIZES!

28 IN.

18 IN.

12 IN.

SPECIAL ADAPTERS INCREASE USES!

Signs-Flashers-Flag Adapters

PAINTED OR REFLECTORIZED

12" size all yellow on black base only. 18" and 28" available in standard tri-color or REFLECTORIZED all-yellow on black base.

NEW! Flasher lights!

Uses standard 6-volt battery. Fits into top of all sizes. Unbreakable plastic lens.

2121

Low cost, long life, light weight make SAFE-T-CONES ideal for every traffic control need. Tough and strong, they're made to last, even with most abusive use.

Write for complete descriptive folder

SAFE-T-CONES are made only by RADIATOR SPECIALTY CO., Charlotte, N. C.

Reference Notes

Fluorescent Lighting for A New York City Parking Area

By Michael S. Dimitri
(Jun. Mem., ITE)
Traffic Engineer,
Ramp Buildings Corporation

New York City's Department of Traffic recently solved a thorny problem of lighting in its first off-street parking project. In the Sunnyside area of the Borough of Queens, was a stretch of unused street just under the concrete-covered steel elevated structure of a portion of the city's subway system. From the standpoint of convenient location this seemed ideal, since the area formed a mall between the two one-way roadways of Queens Boulevard, an artery which accommodated about 45,000 vehicles a day, and is a main access to Long Island. The proposed parking site is also only about 12 minutes subway time from midtown Manhattan, and subway entrances are within a short walking distance.

It was decided to go ahead with improving this tract for both day and night time parking, by paving it, installing meters, and installing a highly efficient lighting system. Here was the big problem: lighting. The use of conventional street lighting standards and luminaires was ruled out because the low clearance of the elevated structure required an excessive number of luminaires, making the cost prohibitive. Mounting luminaires direct to the structure itself appeared to be the answer. The massive supporting columns of the structure divided each block into three bays forming 65-foot squares. The clearance varied from 17 to 33 feet and under these conditions, it was soon found that mercury vapor lighting produced considerable glare. It was feared that this would present a hazard to the fast moving traffic on Queens Boulevard. The answer seemed to be the adoption of fluorescent luminaires, which proved to be very advantageous for this installation. It was found that one such luminaire placed at the center of each bay, and suspended from the elevated structure, provided a desirable light level.

By the use of a luminaire with an adjustable feature, it was possible to vary the light level to compensate for the low mounting height in some of the bays. In the lamps selected (400-watt units 6-feet long) the light source is not concentrated at a single point as is the case in the other type lamps. Objectionable glare and a potential traffic hazard were eliminated.

The lighting units each consist of two luminaires, each containing two 100 watt rapid start lamps, and a 5-inch tube with a shelf arrangement to accommodate a 400-watt ballast and necessary wiring. Because of the vibration induced by passing trains overhead, a floating suspension was required and subsequently designed. This was accomplished by mounting the units from four points using springs under compression to absorb the vibration.

The excellent lighting is paying off very handsomely in several ways. Additional revenue derived from nighttime operation is estimated to completely pay for the cost of installation in less than four years. Vandalism is almost neglibible, and only one incident of damage to a parking meter has been thus far reported. This, in an area where considerable difficulty has been experienced with break-ins to meters located on surrounding streets.

It seems quite clear that good police patrolling and the adopted policy of maintaining all night lighting schedules using efficient, modern lighting in the city's off-street parking areas enhances the value of these areas to motorists, produces good revenue, and minimizes damage from vandalism.

Motor Vehicle Registrations Continue Rise

Motor vehicle registrations in the United States continue to gain and are expected to reach 65,275,000 for 1956, according to an estimate made by the Bureau of Public Roads. Passenger cars will number 54,300,000, a 4.1 per cent increase over 1955. Trucks and buses are expected to total 10,975,000, a gain of 3.7 per cent. The total number of motor vehicles is expected to reach 81 million by 1965.

New York Compulsory Insurance Law

New York's compulsory insurance law will affect about 5 million vehicle owners and 6½ million licensed drivers. It has been estimated that there are about 700,000 uninsured motor vehicles in the State. Every vehicle must be covered by liability insurance in the sum of 10/20/5 in order to be registered. This insurance must be kept in force continuously or the owner will lose his license plates and in some circumstances his driver's license.

GET A QUOTE on *Cataphote* before you buy TRAFFIC SIGNS

All Standard Legends ... Plain or Reflectorized ... Steel or Aluminum ... Meet All State and U. S. Standard Specifications

Popular new standard white on red stop sign shipped from stock.

Cataphote represents a single source for you to obtain *all* your street and traffic marking items from special signs to nuts and bolts, including, of course, all the standard traffic signs. Both materials and fabrication, as well as design, comply with U. S. STANDARDS in every respect.

As a sign manufacturer, with over a quarter century of experience and service, Cataphote manufactures its own reflectorizing materials for reflective signs ... famous Cataflex Reflective Coating and Cataphote Reflector Buttons. With our own manufacture of these items, we are able to provide brilliant, long lasting, reflectorized signs of the highest quality.

Before you invest more in signs, investigate Cataphote quality, service and economy.

For Traffic Sign Shops CATAFLEX Reflective Coating Kits! Easiest-to-use, least expensive method of brilliant reflectorization. No special equipment or training needed. Silk screen, roller coat, spray or brush application. Send $25 for Trial Kit (100 sq. ft.) and free catalog TP3.

Good looking, long lasting Cataphote Street Name Signs are *guaranteed for three years.* Made of 18 gauge zinc-coated steel with embossed letters and borders, they have three coats of high gloss enamel baked on. Mounting brackets to fit your needs.

Write today for Catalog 12TS

Cataphote CORPORATION

Toledo 10, Ohio and Jackson, Miss.

Reflective Traffic Products:

- CATAFLEX SIGN KITS
- CATAPHOTE TRAFFIC SIGNS
- CATALINE REFLECTIVE STRIPING
- CATAPHOTE REFLECTIVE BEADS

Professional Service Directory

BRUCE B. MacDONALD
TRAFFIC ENGINEER

TRAFFIC ENGINEERING SERVICES IN WESTERN NEW YORK AREA

Write: Roy E. Pratt, P. E.
31 Waverly Street, Springville, New York
or Call Springville 626

TRAFFIC ENGINEERING **HIGHWAY PLANNING**

BRUCE CAMPBELL & ASSOCIATES
ENGINEERS

177 MILK STREET • BOSTON 9

PARKING **AIRPORTS** **SHOPPING CENTERS**

WHEN YOU CHANGE YOUR ADDRESS

. . . please notify us promptly. Your copies of "TRAFFIC ENGINEERING" will then reach you without delay and without interruption.

DE LEUW, CATHER & COMPANY
CONSULTING ENGINEERS
Transportation, Public Transit and Traffic Problems
Subways, Railroads, Industrial Plants
Power Plants, Grade Separations,
Expressways, Tunnels, Municipal Works
150 N. Wacker Drive, Chicago 6, Ill.
79 McAllister St., San Francisco 2, Cal.

Highway Traffic Engineers, Inc.
345 Boylston Street
Brookline 46, Massachusetts
LOngwood 6-0275

POSITIONS AVAILABLE

EVANSVILLE, INDIANA

Position: Assistant Traffic Engineer.

Requirements: Engineering graduate with discernible interest in field of traffic engineering to work in small department permitting progressively responsible experience.

Salary: $4500.00 per year

Apply: Robert L. Jaffe
Traffic Engineer
City Hall
Evansville, Ind.

CONSULTING FIRM

Position: Traffic Engineer.

Requirements: Graduate Engineer with at least one year of traffic engineering experience or education. Experience in highway engineering desirable but not necessary. Live in or near Boston.

Salary: $6500 to $8000

Apply: Box 117 % ITE Headquarters.

FORT LAUDERDALE, FLORIDA

Position: City Traffic Engineer

Qualifications: Engineering graduate, with one year of graduate study or equivalent. U. S. Citizen, age 21-45.

Salary: $5,525 to $6,903 per year.

Apply: Robert A. Earle, Personnel Director, City Hall, Ft. Lauderdale, Florida.

INDEX TO ADVERTISERS

AB Sveatrade	149
A'G'A Division of Elastic Stop Nut Corporation	139
Aluminum Company of America	112
Automatic Signal Division of Eastern Industries	137
Cataphote Corporation	153
Crouse-Hinds Company	107
Dual Parking Meter Company	110
Duncan Parking Meter Corporation	Inside Front
Eagle Signal Corporation	133
Eastern Metal of Elmira	141
General Electric Company	121
Harbor Plywood Corporation	130 & 131
Minnesota Mining and Mfg. Company	108
Prismo Safety Corporation	Back Cover
Radiator Specialty Company	151
Veeder-Root	140

Professional Service Directory

EDWARDS, KELCEY and BECK
CONSULTING ENGINEERS

Surveys — Reports — Economic Studies — Design — Supervision
Transportation — Traffic — Parking — Terminals — Port and Harbor Works
Highways — Expressways — Grade Separations — Tunnels
Bridges — Water Supply — Management

3 William Street, Newark 2, N. J. • **250 Park Avenue, New York 17, N. Y.**

PARSONS, BRINCKERHOFF HALL & MACDONALD
Engineers

Bridges, Highways, Tunnels, Airports, Subways, Harbor Works, Dams, Canals, Traffic, Parking and Transportation Reports, Power, Industrial Buildings, Housing, Sewerage and Water Supply.

51 Broadway **New York 6, N. Y.**

THE H. K. FERGUSON COMPANY
ENGINEERS AND BUILDERS

PARKING AND TRAFFIC SURVEYS • ECONOMIC STUDIES
GARAGE DESIGN AND CONSTRUCTION

New York - Cleveland - Cincinnati - Chicago - Atlanta
Los Angeles - San Francisco - Toronto - London

HARDESTY & HANOVER
CONSULTING ENGINEERS

BRIDGES — Long Spans of All Types
Movable — Lift, Bascule & Swing
Hanover Skew Bascule
Grade Crossing Eliminations
Other Structures Foundations
Expressways and Thruways
Design — Supervision — Inspection
Valuation — Reports

101 Park Avenue **New York 17, N. Y.**

PALMER AND BAKER, INC.
CONSULTING ENGINEERS — ARCHITECTS

Surveys — Reports — Design — Supervision — Consultation
Transportation and Traffic Problems Tunnels Bridges Highways Airports
Industrial Buildings Waterfront and Harbor Structures
Graving and Floating Dry Docks
Complete Soils, Materials and Chemical Laboratories

Mobile, Ala. **New Orleans, La.** **Harvey, La.**

S. Herbert Taylor Frank J. Sleeper
David L. Taylor William H. Taylor

SHERMAN, TAYLOR & SLEEPER
CONSULTING ENGINEERS

501 Cooper Street, Camden 2, N. J.
EMerson 5-0555
Park & Norwod Aves., Pennsauken 8, N. J.
MErchantville 8-4848

GANNETT FLEMING CORDDRY and CARPENTER, INC.
- - - ENGINEERS - - -

CONSULTING SERVICE FOR TRAFFIC, PARKING and TRANSPORTATION PROBLEMS
City Planning — Highways — Bridges — Flood Control
Water Supply — Sewerage— Industrial Waste — Garbage Disposal
Appraisals — Investigations — Management

600 NO. 2nd STREET HARRISBURG, PA.
Pittsburgh, Pa. Philadelphia, Pa. Daytona Beach, Fla. Medellin, Colombia, S. A.

JENKINS, MERCHANT & NANKIVIL
Consulting Engineers

Municipal Improvements Sewerage
Power Development Water Systems
Traffic Surveys Industrial Plants
Flood Control Recreational Facilities
Airports Investigations and Reports

805 East Miller Street
Springfield, Illinois

TRANSPORTATION PROBLEMS
HIGHWAYS

THE CLARKESON ENGINEERING COMPANY
INCORPORATED

285 Columbus Ave., Boston 16, Mass.
COmmonwealth 6-7720

EXPRESSWAYS **AIRPORTS**

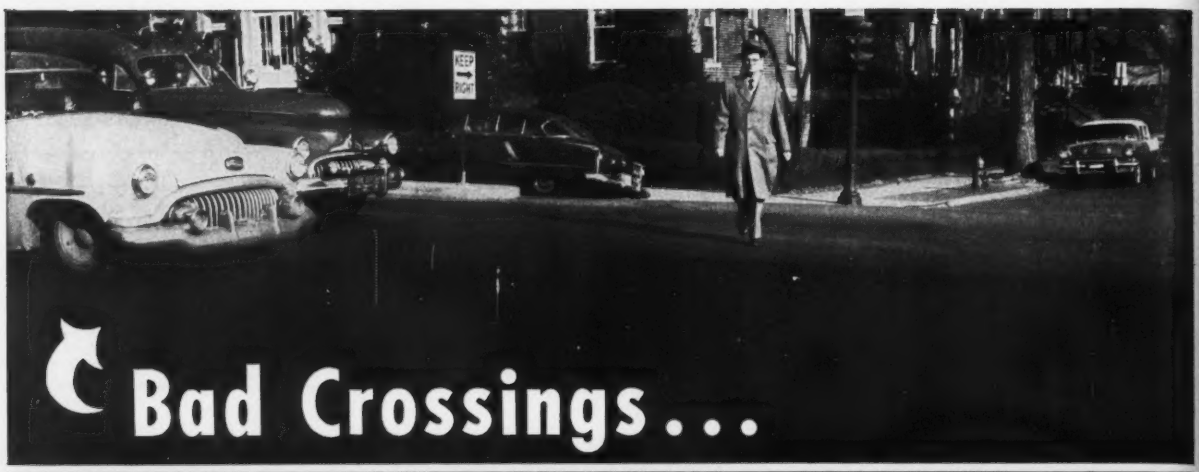
AMMANN & WHITNEY
CONSULTING ENGINEERS

Design and Supervision of Construction of Bridges, Highways, Expressways, Buildings, Special Structures, Airport Facilities

111 Eighth Avenue, New York 11, N. Y.
724 E. Mason Street, Milwaukee 2, Wisc.

TIPPETTS — ABBETT McCARTHY—STRATTON—BRYANT
Engineers
Traffic, Parking and Transportation
Surveys, Economic Studies and Financial Reports
Highways, Subways, Bridges, Tunnels—Airports, Ports, Harbors, Power Developments, Water Supply, Sewerage
Planning, Reports, Design, Supervision of Construction

62 West 47th St. 110 Market St.
New York 36, N.Y. San Francisco, Cal.



Bad Crossings...

call for PLASTIX

NEW Plastix Catalog

Gives you the complete Plastix story—all the details about the many Plastix standard shapes, prefabricated letters, numerals, symbols and letters . . . where and how to use them for pavement markings of all kinds. Fully illustrated with photographs, charts and drawings. Just write for Plastix Catalog No. PX-56

Blacked-out pavements at intersections are danger zones. You can easily change the picture and cut down pedestrian accidents by installing Prismo Plastix permanent-type reflective pavement markings at all crosswalks.

Plastix is an extruded thermo-plastic material uniformly impregnated throughout with microscopic optical glass spheres. It shines out bright and clear at night, and its sparkling brilliance is undimmed by fog, smog, drizzle or downpour. Application is fast and simple, and within a short time Plastix actually becomes an integral part of the road surface. Even pavement faulting will not affect Plastix as it is capable of resealing itself.

From the moment it is put down, Plastix gives maximum reflectivity, which normally lasts four or more years. Plastix provides traffic engineers with *the* economical, effective and long-lasting reflective material for modern traffic pavement marking requirements.

The SPHERE of SAFETY

PRISMO SAFETY CORPORATION

HUNTINGDON, PENNSYLVANIA